the OIL AND GAS JOURNAL
PUBLISHED WEEKLY DECEMBER 4, 1961

Big compressors put versatility into

Air Drilling

p.122

Mobile mill makes pipe on right-of-way 95

New offshore hope: floating drill barge 100

Jersey plans huge flood in Zelten field 117

Petrochemical capacity still climbing fast 131

New foaming agents for gas-well cleanout 167

Your fastest way to locate those refiners who have Equilibrium Catalysts for sale is to use this new service from Davison. *

THE CATLOCATER

AUGUST, 1961

As a part of our continuing customer service program, Davison provides this bi-weekly availability bulletin on Equilibrium Fluid Cracking Catalysts. The sources listed herein and quantities available are constantly subject to change so that these figures are approximations only, based on the latest information available at the time of this mailing.

Whenever you need information or assistance concerning Cracking Catalysts, Mullite, Aluminas, Microtraps, and allied products, the number to call is 727-3912 in Baltimore.

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W. R. GRACE & CO., Davison Chemical Division, 101 N. Charles St., Baltimore 3, Md., Att: Mr. J. W. Cugle - Catlocater Dept.

OIL AND GAS JOURNAL
Vol. 59, No. 49

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Technology

Drilling

Big compressors help air drilling 122

by Ed McGhee

Rocky Mountain drillers have access to new air-drilling equipment which, in effect, has its own booster compressor built in. This important new equipment is a trailer-mounted, 550-hp. machine which compresses air in four stages. Earlier equipment was generally less powerful and customarily used only two or three stages.

Refining-Processing

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Radiant heating cuts costs of batching lube grease—New lab geared for flexibility—Computer control for oxidation units—New superfractionator goes on stream.

Tenneco boosts catcracker capacity 128

by H. C. Bozeman

An outstanding revamping feat was performed by Tenneco Oil Co. with its cat cracker at Chalmette, La., when rating was raised from 9,500 bbl. daily fresh feed to 17,500 bbl. Catalyst circulation increased only 20%. Expansion was accomplished by adding a booster blower, a feed preheat furnace, a main fractionator, and a new gas plant.

New construction hikes petrochemical capacity 131

by Robert B. Bizal

Latest report on new plants and expansion programs in the U. S. and Canada shows 97 projects in the works. The company-by-company survey lists 12 ammonia projects, 13 for olefins and derivatives, 10 for aromatics, 8 for polyolefins, 8 for naphthalene, and others.

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Vanadium in California oils—How does Russia compare?

How centrifugal compressors work with industrial gases 141

by Walter A. Snow

Other than air-handling service, there are seven broad areas of application: (1) industrial refrigeration; (2) hydrogen reforming; (3) various feed-gas, off-gas, or wet-gas streams; (4) pipeline compression; (5) toxic chemical gases; (6) coke-oven gases; and (7) oxygen handling.

Nelson cost indexes 164

Production

Slim-hole completions save money 150

By Philip L. McLaughlin

The economy of slim-hole completions depends on who makes the calculations, the basis of the computations, depth, area, and other factors. But a substantial degree of success has been demonstrated, and it's likely that this technique may be another step in progress.

New foaming agents for tough gas-well cleanout 167

by H. N. Dunning, J. B. Thielen, and D. L. Anderson

Some oils and some oil-and-brine mixtures resist ordinary foaming agents. And other agents promote corrosion by scrubbing protective-oil coatings from pipe surface. Here are some recent advances in foaming-agent technology that will help solve these operating problems.

Pipelining

Least relaying time eases pipeline-utility conflict 158

by O. F. Zedler, Jr. and L. U. Edison

Final test of relay-coordination plan is smooth integration with supply utility's system. Seeking the shortest relaying time avoids most conflicts.

Oil pipelines show gains in revenues and volume 172

by John P. O'Donnell

But net income and return on investment fell in 1960. Interstate lines have $3.3 billion in property, spent $152 million for equipment last year.

THE OIL AND GAS JOURNAL **Newsletter**

December 4, 1961

Significant this week

World's first machine that makes line pipe while moving along right-of-way is at work in North Texas.

Tractor-driven mill produces finished pipe in lengths of 800 to 900 ft. from coils of hot rolled steel.

On project near Wichita Falls, 4,000 ft. of 8-in. pipe was rolled, welded, and strung in 1 day last week (p. 95).

Strong case for tighter oil-import controls was made at House subcommittee hearing.

That's the reaction of Democratic Rep. Tom Steed of Oklahoma and other subcommittee members. Steed is sending transcript of hearing to White House, along with covering letter which urges cut in import totals as national security measure.

He gave impression that subcommittee will be sharply critical if administration doesn't plug what he feels are loopholes in current imports program (p. 102).

Drill ships made headlines of various kinds last week:

—Ordinary submersible drilling barge is being modified by Blue Water Drilling Co. so it can drill while afloat.

If experiment works, deepest offshore waters would be open to many rigs now confined to shallow waters (p. 100).

—Global Marine Exploration launched CUSS II, first floating drill ship designed for work at any depth. If owners are successful in bidding, it may be used for intermediate Mohole drilling. Global's CUSS I did early Mohole work (p. 100).

—Another Global drill ship, the SM-1, sank in a fierce storm off California (p. 101).

—Floating drill ship, Nola III, is en route to make first tests in Shell's prize marine concession off Kuwait (p. 118).

Here's a new twist in air drilling: four-stage, trailer-mounted compressors which eliminate any need for boosters.

Now being used in Rocky Mountain drilling, such compressors handle up to 1,180 c.f.m. at 1,250 psi. (p. 122).

Oil firms have rediscovered their No. 1 public: industry employes. This is reflected in company publications.

Instead of "glamor" articles, such publications now carry straight talk about profits and company problems. API's Committee on Public Affairs is helping to create new look. Its staff offers materials for informational programs (p. 104).

Stripper-well output in U. S. is on the upswing.
Latest survey shows two out of three wells are strippers making less than 10 bbl. daily, and that they produce more than a fifth of nation's crude. Production in 1960 totaled about 574 million barrels, a jump of 41 million (p. 99).

Petrochemical construction keeps going at a fast clip.
At the moment, 97 domestic projects are on tap. Latest Journal tally shows 85 projects under way or scheduled in U. S., 12 in Canada (p. 131).

National Petroleum Council has sent out questionnaires seeking data on petrochemical manufacture.
Information will be kept confidential, except that certain governmental agencies will use it in defense planning (p. 103).

In another development, NPC has agreed to make study on how soviet-bloc oil exports affect free world.
Request for study came from Interior Department. It will be used in analysis of growing problem of Russian oil penetration (p. 103).

In oil news abroad:

Esso Libya expects to double oil output from huge Zelten field through $50-million primary water-injection program.
Plans call for 36-in. pipeline to move seawater from Mediterranean to Zelten, across 110 miles of Libyan desert. So far, there's no definite timetable for project (p. 117).

New Indian squeeze play on product imports is keyed to Russian oil (p. 118).

U. S. banks and oil firms are showing confidence in Japanese oil boom through granting of heavy loans (p. 119).

News in the making

Appalachian region is in throes of leasing and geophysical binges that point to deep-drilling programs on large scale.
Such programs probably will start in 1962.
Majors continue to move into area. Exploration offices have been opened in Pittsburgh, Columbus, and Evansville. Texaco has opened an office in Richmond, and seismic crews are moving into Maryland, as scope of activity widens to the East.

Nebraska, ahead of all other Rocky Mountain states in total 1961 drilling, may widen its lead next year.
Operators are looking at Cambridge and Chadron arches, and "over the hump" at Central Nebraska basin, for future targets.
Pan American and Belco Petroleum have given farmouts on large areas of state.

How soon will digital computers in complete systems be available for seismic work?

One expert predicts digital methods will start replacing current analog techniques in a year or so. Several companies are working on development.

Point to think about: if separate systems are devised, chances for standardization will be slim.

Possibility of steel strike next summer is already casting shadows in oil patch.

Reliable source says at least two major mills are trying to get customers to take, in first two quarters of 1962, enough tubular goods to last through third quarter. Current steel labor contract runs out June 30.

Other major mills profess not to be alarmed. They aren't advising customers to stockpile.

Look for new efforts in hunt for better ways of removing detergents and other synthetic organic chemicals from waste water.

Esso Research & Engineering has been awarded $49,000 Public Health Service contract for work along these lines.

Use of detergents has become so widespread that some investigators feel they may represent health problem. Esso will use foam-fractionation technique in its research, one of several such projects authorized under 1961 amendments to federal Water Pollution Control Act.

Keep an eye on developments in Cletrac Corp.'s proposed acquisition of Hess family oil interest.

Proxy material is before Securities Exchange Commission for clearance. Stockholders of Cletrac, which makes crawler-tractor and road-building equipment, are expected to vote on deal in January. Reportedly, $100 million is involved.

Something interesting could result from Consolidation Coal's current survey of oil and gas industries, among others, as possible places for investment of its accumulating cash.

Consolidation is already in the coal-pipeline business.

Close race is being waged between Sun Oil and Tidewater Collier in completion of their new naphthalene plants.

Both of the 100-million-pound-yearly plants probably will be on stream by mid-December. They're the second and third. Ashland's plant, completed early this year, was first of its kind. It is reported to be operating well above its 50 million-pound-yearly design capacity.

Is Detroit getting ready to reverse the pell-mell rush to compact cars, as result of surprising change in public taste?

Compact sales in recent months have halted their upward trend, in any event. Sales of compacts have fallen from 38% of total sales to 30%.

Market memo

Dec. 4, 1961

Oil men should be forewarned: Some responsible executives reportedly favor asking Government to referee the oil marketing battles.

Their reasoning: Market stability can only be restored with a set of government-approved fair trade practices. It's better to sacrifice a little freedom of action in order to keep marketing profits from going down the drain. Most executives still oppose such a move, however.

From **market confusion** surrounding Gulftane, these straws are in the wind:

. . . **Move matching Gulf's** new low regular is being considered by at least one or two other majors. It'll be simple for those with three grades now. Cost for others may not be so prohibitive as some think. Everyone has extra pumps—new tankage and distribution are the big problems. By limiting third grade to high volume areas, even these costs may be held down. Tenneco, in introducing its subregular in Houston, is following this approach.

. . . **Texaco indicates** it will stick to two grades for present. The No. 1 domestic marketer wants no part of a third grade unless conditions force it to move.

. . . **Multigrade marketing** through blending pumps is being abandoned by **Tidewater.** Company has been testing data in three eastern towns since April, has decided it isn't feasible.

. . . **A 50-50 bet:** Other majors will find a way to live with Gulftane, ease up in fighting it with price of their regulars. A likely price level may be Gulftane at 1 cent under major regular and 1 cent above private branders' regular.

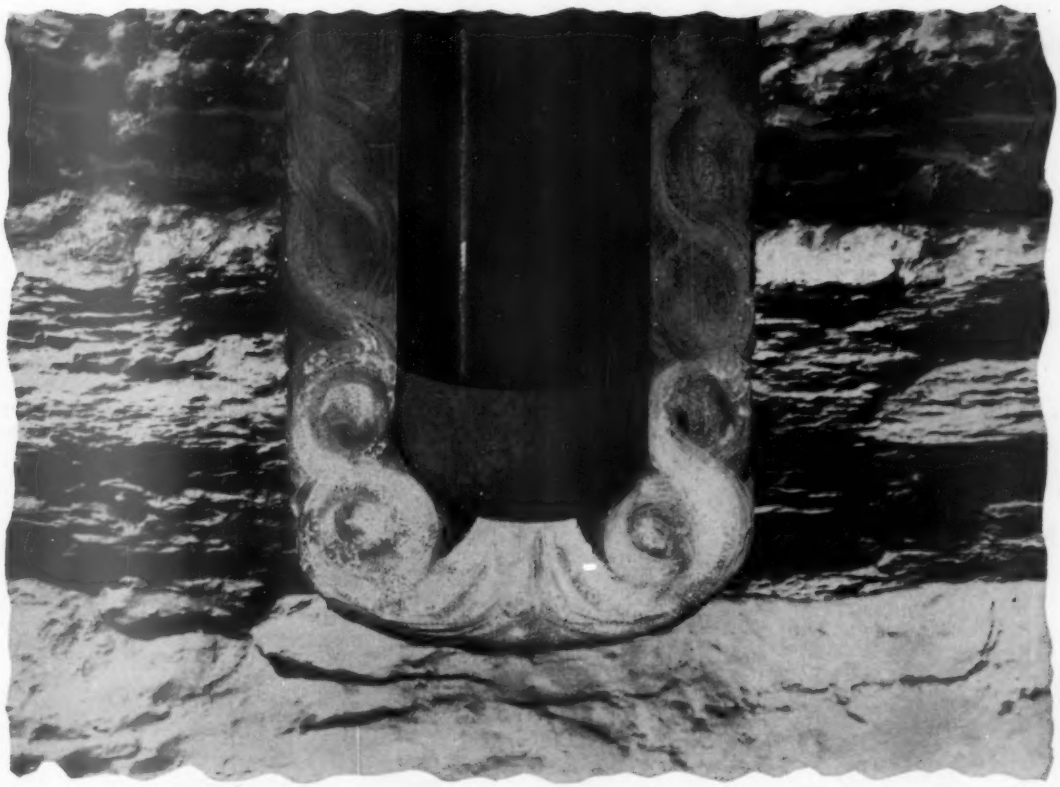
Wild gasoline **fluctuations continue in test cities** of Buffalo and Norfolk where Gulftane was installed last summer. Gulftane is meeting private brand regular or riding 1 cent above, and in Buffalo skidded to dealer tank wagon price of 4.1 cents—1 to 2 cents below major regular—before other majors started move upward. In High Point, N. C., when Gulftane came in, pump prices on regular dropped to 16.9 cents, which after taxes and hauling leaves 3.5 cents per gallon. That's not enough even to pay the dealer's margin.

Reaction was delayed as Gulftane entered some new markets in the East. In New Jersey, a fair trade state, Gulftane moved in at the customary 2 cents below major regular and even with most private brands. This still left a group of price cutters 1 to 2 cents below Gulftane. The majors generally stood pat, and so did private brands in the initial stages.

Trend of spot markets: All areas are dormant now—it's a case of waiting on the weather. It's past time for removal of discounts from heating oils on the East Coast. Such a move would stimulate activity on the gulf. No. 2 is quiet in all markets but in good condition for price pickup with severe weather. Gasoline is firm on the gulf and Mid-Continent with some chance for a price rise in the midlands.

Advertising program can increase automobile travel and consumption of gasoline. That's conclusion drawn from API travel-development advertising campaign this summer.

The major findings: Favorable attitudes toward leisure time use of car increased. More families in the test markets took trips of the type promoted—and they were longer trips. Car mileage from the "API trip" category was 50% higher in the test markets.



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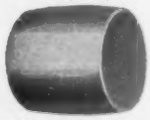

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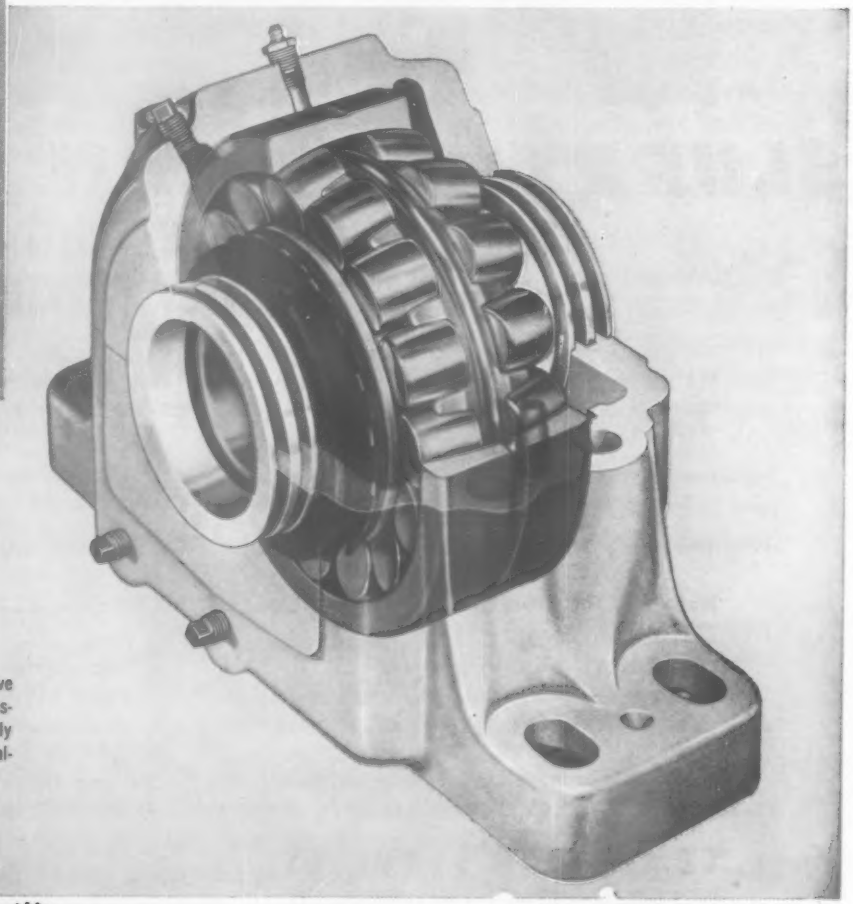

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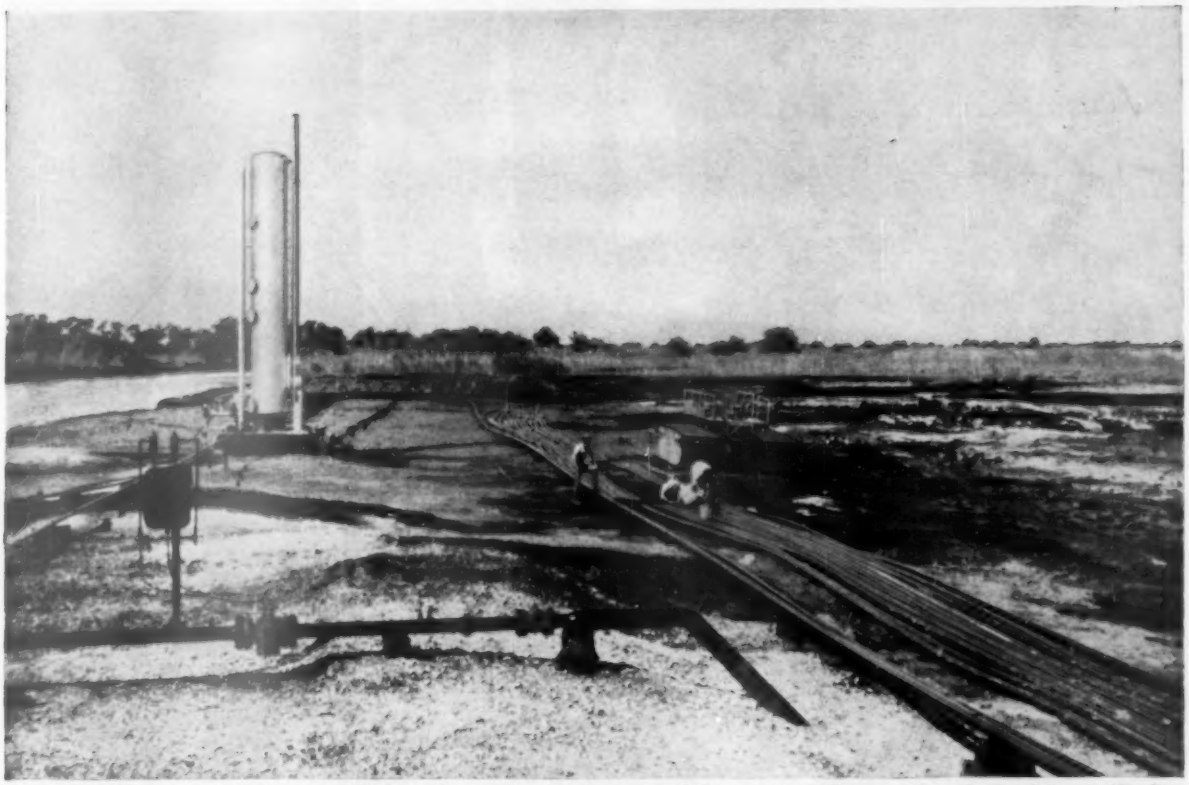

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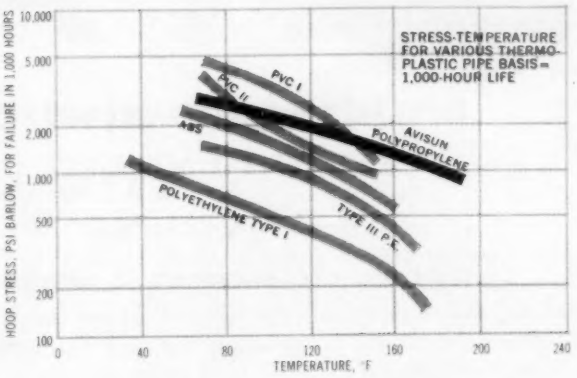

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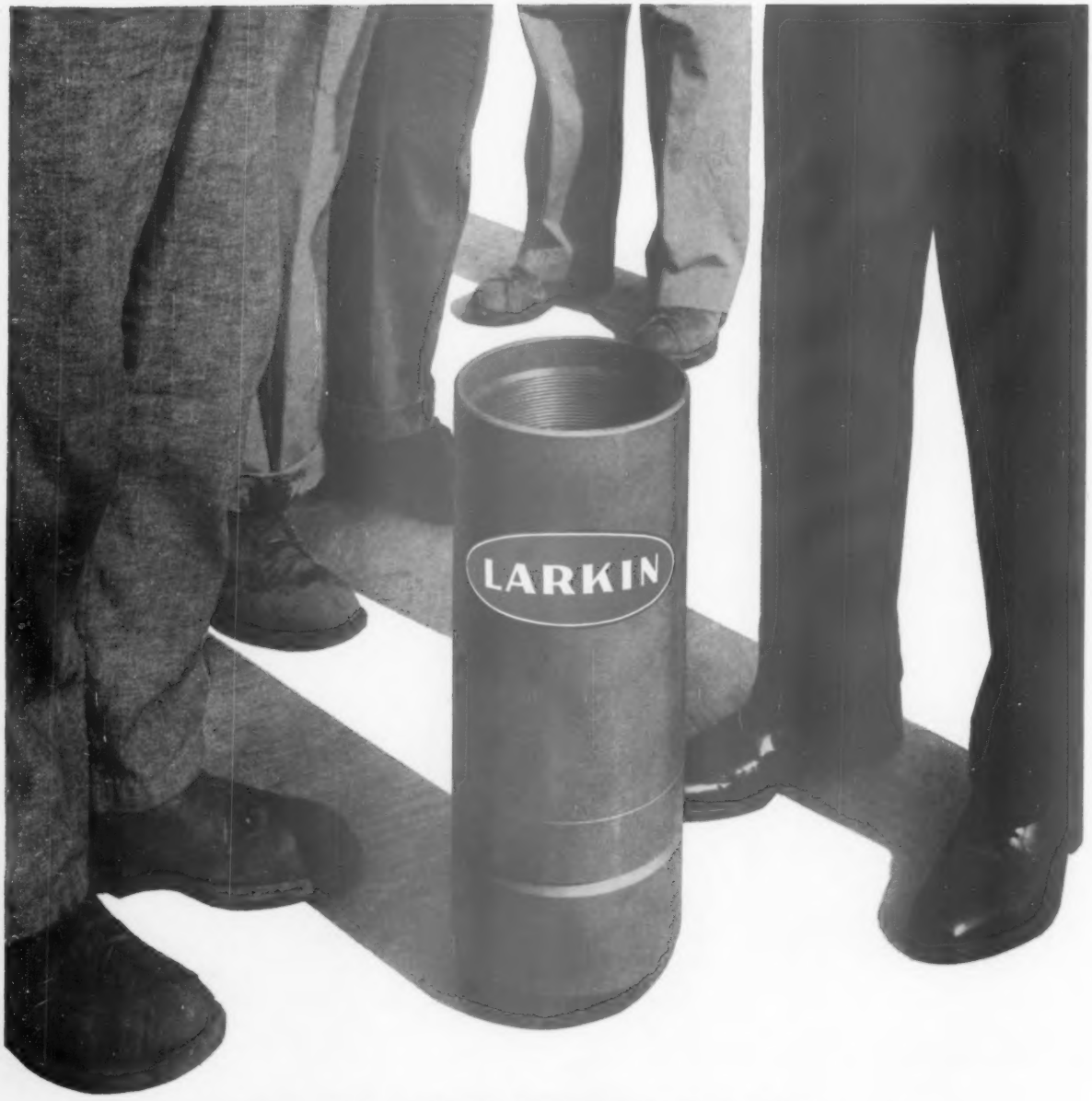

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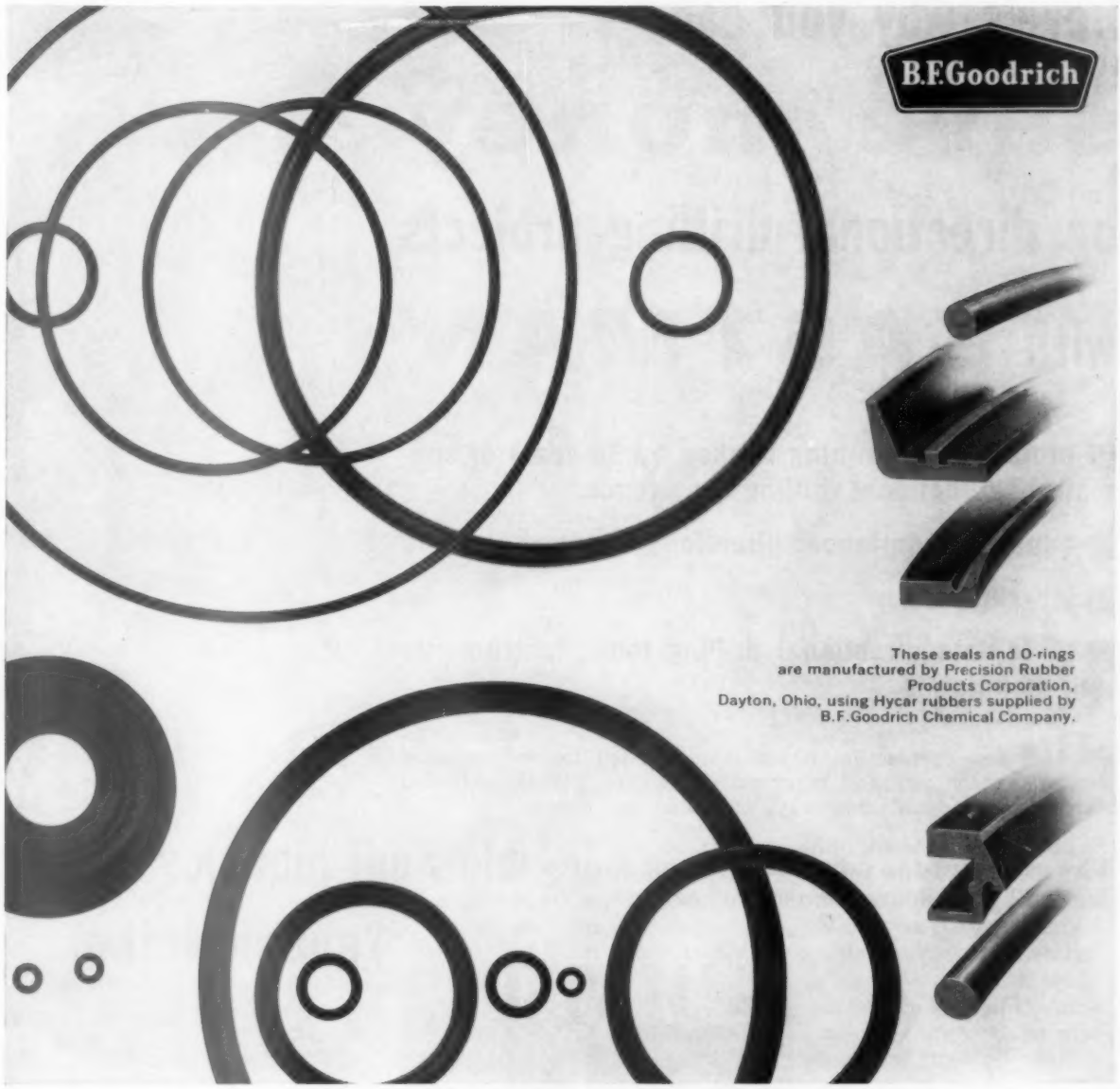

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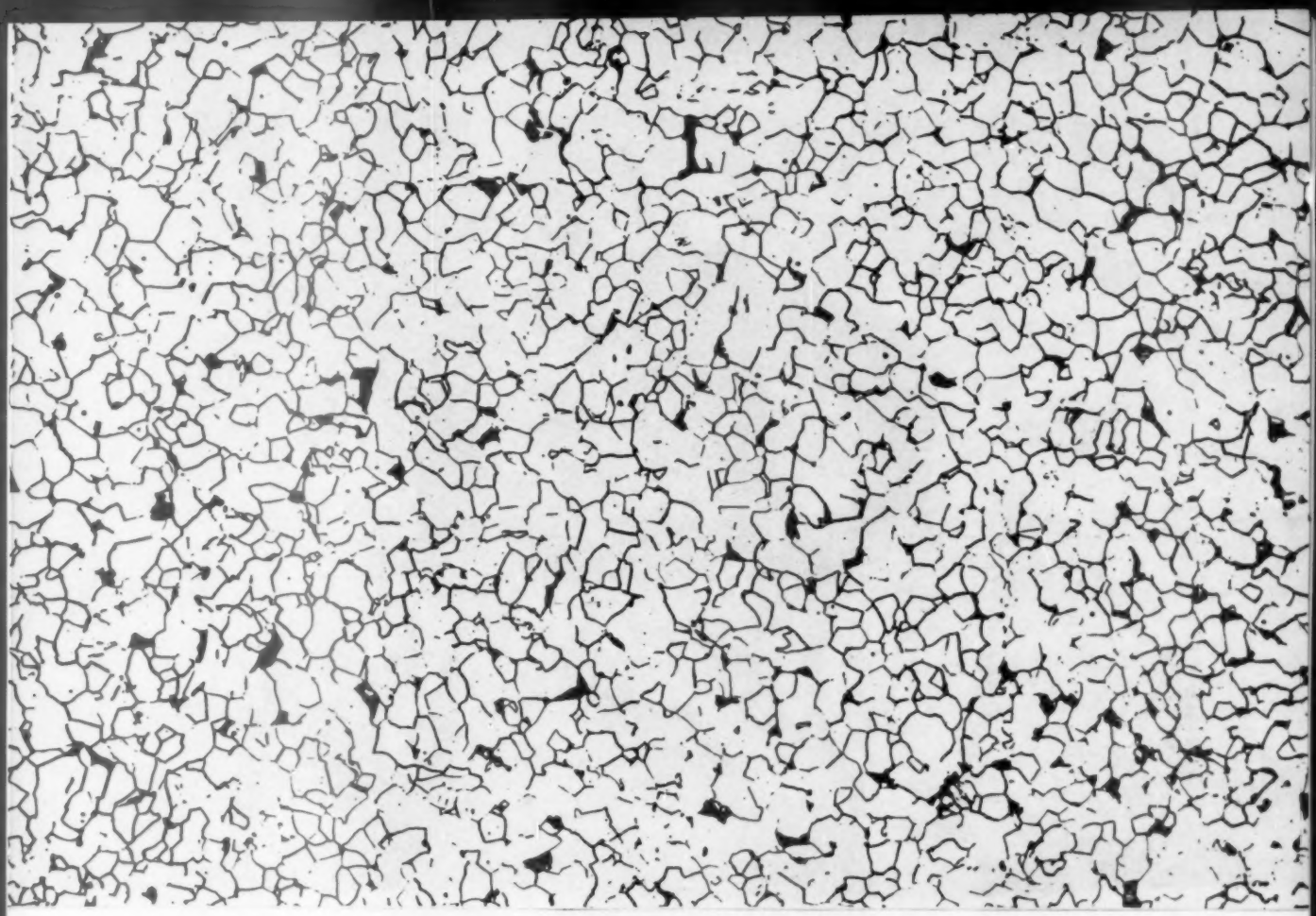

Can you spot the weld in this picture?

If you can't see a weld in this magnified photo of a steel tube, there's nothing wrong with your eyesight. Even though the weld section has been magnified 100 times, you can't see the weld because it's perfect—but you could spot a flaw immediately. That's why we use metallographic examination like this to check Electric Resistance Welded Pressure Tubes. In addition to checking the weld, we also examine the grain structure of the steel tube to make sure it's consistent.

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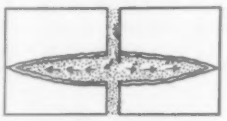

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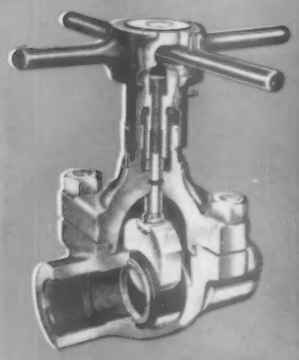

Figure 2126 Resilient Seat Gate Valve. 2", 3", 4", 2000 lb W.P. EValcoat protective Plastic Coating.

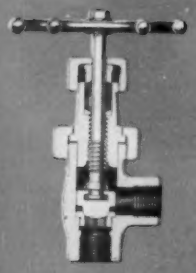

Figure 2699 Forged Steel Angle Valve. ½", ¾", 1", 2000 lbWOG. Not Plastic Coated.

Figure 152J Forged Steel Gage Valve. Size ½", 4000 lb WOG. Not Plastic Coated.

Figure 2498 Throttle Disk Forged Steel Globe Valve. Size 1", 2000 lb WOG. EValcoat Plastic Coating.

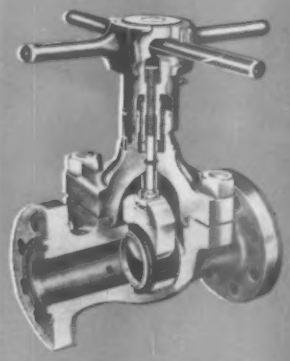

Figure 3116 Resilient Seat Gate Valve. 2", 3", 4", 2160 lb W.P. EValcoat protective Plastic Coating.

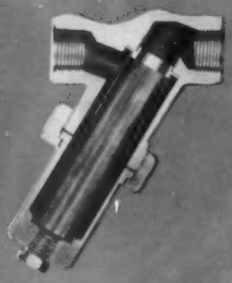

Figure 126 Forged Steel Strainer. Size 1", 2000 lb WOG. EValcoat protective Plastic Coating.

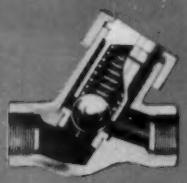

Figure 2676 Forged Steel Check Valve. Size 1", 2000 lb WOG. EValcoat protective Plastic Coating.

Figure 448 Forged Steel Globe Valve. 1½", 2", 2000 lb WOG. Not Plastic Coated.

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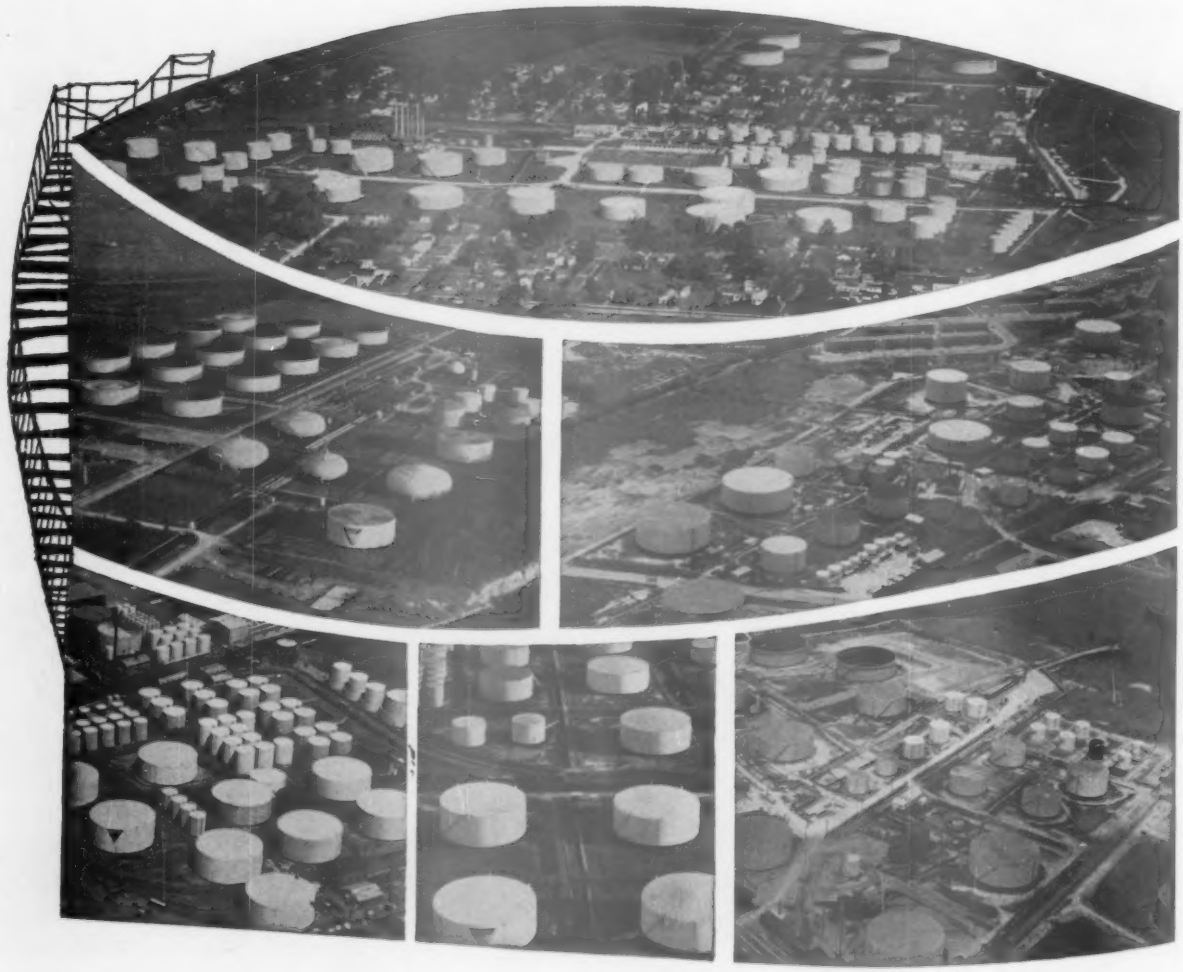

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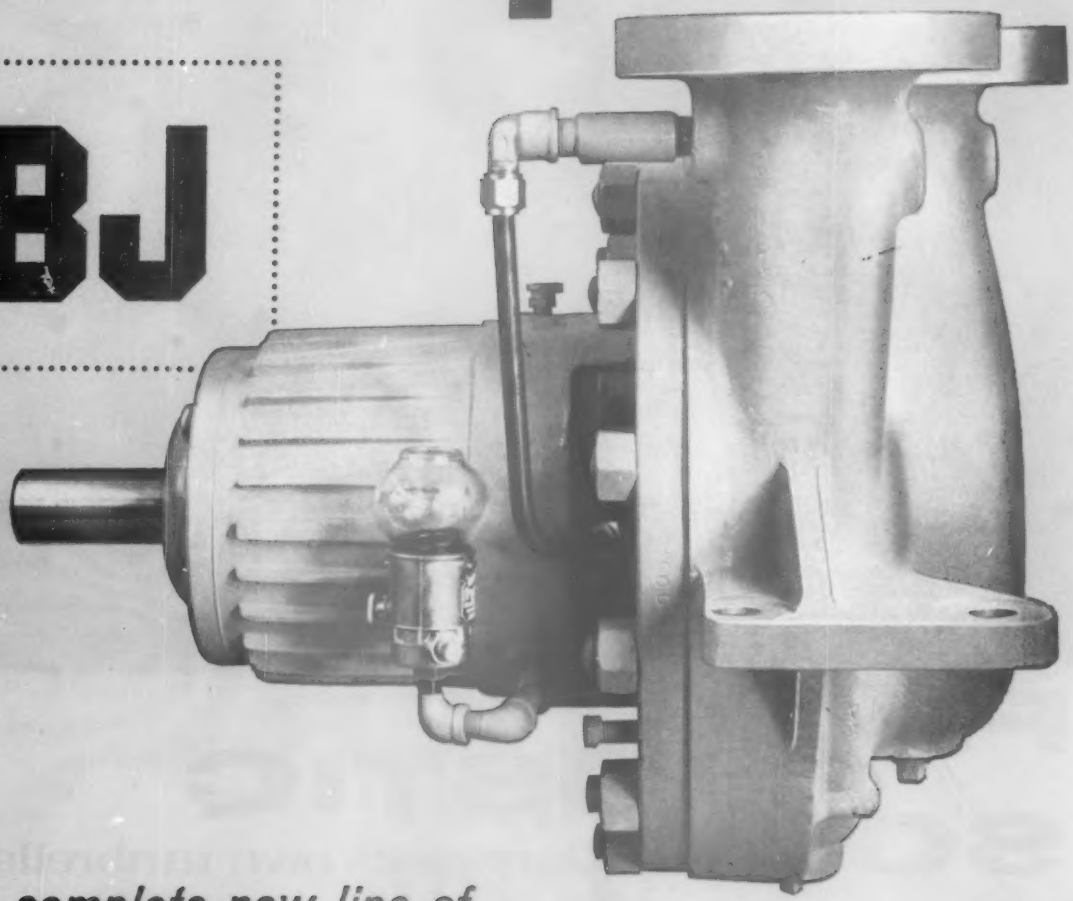
BJ



A complete new line of

Process Pumps

designed for maximum interchangeability

Up to 72 basic combinations of this compact new BJ Pump can provide a custom-engineered pump for almost any process pumping application—*from standard, off-the-shelf parts!*

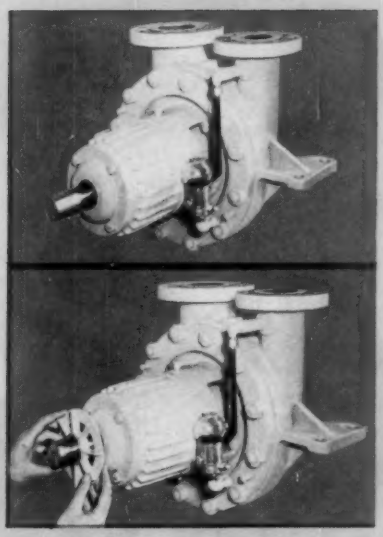
Two types, models SMJ and SMJI, offer standard stuffing box construction or an internally sealed version. With either, a choice of impellers, covers, nozzle arrangements, bearing construction, cooling methods and other components allow you to custom-engineer the pump to the job without buying features that aren't required for the service.

Also, standard, interchangeable parts simplify stocking where a number of different pump applications exist in a single plant, and the compact design saves valuable floor space when installed.

Centerline supported, single stage, the SMJ and SMJI are vertically split with either top or end suction.

Model SMJ is suited for high temperature service to 850°F, and the SMJI for a maximum of 400°F. Both are available to 1,200 gpm, and with heads to 700 feet and pressures to 700 psi!

Fan Cooled*!



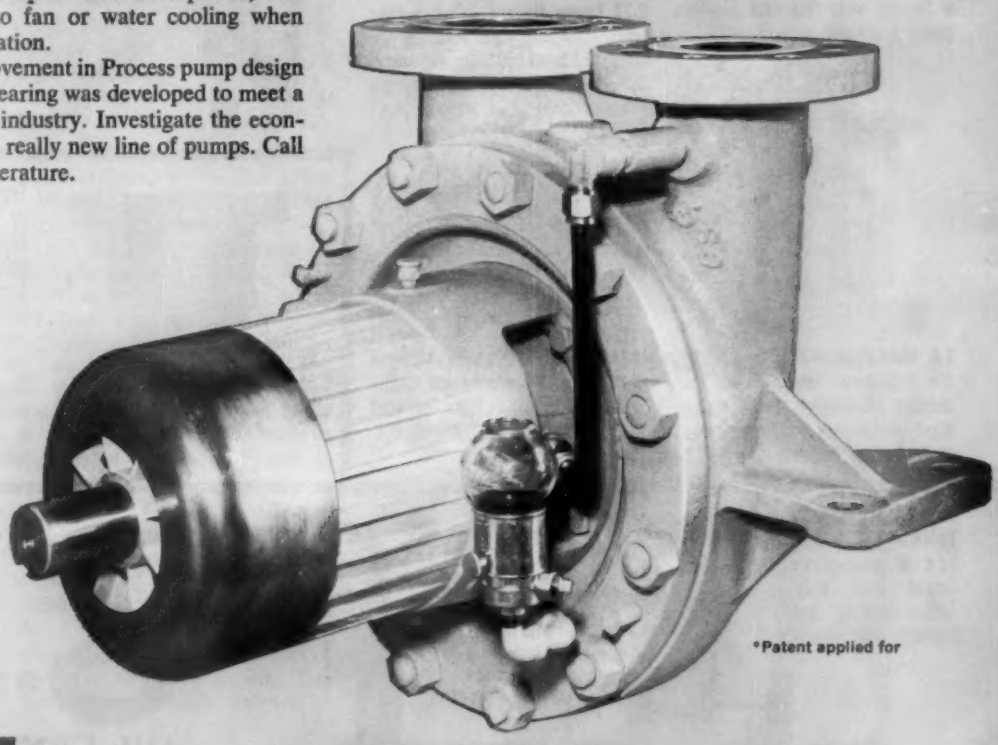
Models SMJ and SMJI Process Pumps

Now an exclusive *fan cooled* bearing housing available on Byron Jackson SMJ and SMJI Model Process Pumps can entirely eliminate a cooling water supply to the bearings! This feature was designed to eliminate engineering, installation, maintenance and operation costs of a cooling water supply, and can prevent costly freeze-ups in severe climates.

Simple, efficient and trouble-free, it works like an air-cooled electric motor. A fan mounted on the shaft behind the bearing draws cool air over the thrust bearing and out over the cooling fins of the housing. For lower temperature service the same pump can be used as a simple air cooled bearing, without the fan and fan cover, using the cooling fins alone to dissipate heat.

Only two different bearing housings fit all models of vertical SMI and SMJI's up to 300 horsepower, and either may be adapted to fan or water cooling when purchased or after installation.

As the first major improvement in Process pump design in years, this fan cooled bearing was developed to meet a long-existing need of the industry. Investigate the economy and efficiency of this really new line of pumps. Call or write for descriptive literature.



*Patent applied for

BYRON B-W JACKSON BORG-WARNER

Byron Jackson Pumps, Inc.

Subsidiary of Borg-Warner Corporation

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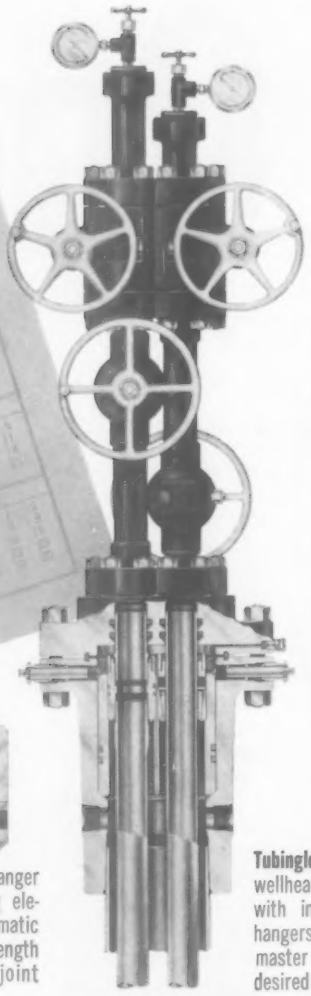
1961 Brought you these NEW O·C·T products



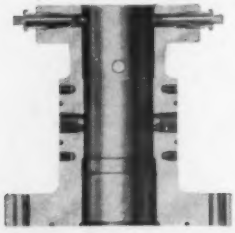
Again this year your needs for new types of wellhead equipment, to use with improved completion techniques, have kept us busy.

Here are the new designs introduced by O.C.T. during 1961.

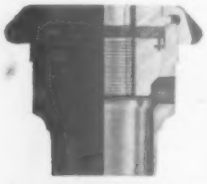
C-21 Casing Hanger — The C-21 consists of slips, slip bowl, and a floating seal ring that provides positive annulus packoff.

C-22 Casing Hanger — This hanger features a single-unit sealing element, slip bowl and slips; automatic seal; and load-carrying strength greater than the pipe's joint strength.

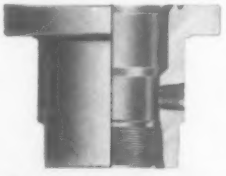
Tubingless Completion Wellheads — These wellheads give you maximum flexibility, with interchangeable slip and threaded hangers, a variety of casing heads, and master bushings to allow assembling any desired single or multiple completion.



T-C Multi-Head — This is a versatile tubing or casing head that accepts 13 different threaded and slip-type hangers for single, dual, or triple completions.



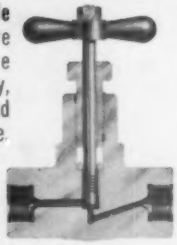
Independent Wellheads — These forged steel, low-pressure casing and tubing heads feature low cost and maximum parts interchangeability.



C-22 Casing Head — A straight-bore casing head designed to support maximum loads and to accept any of three interchangeable hangers.

Type M Tubing Heads — These macaroni tubing heads are designed for hanging 1½-inch and smaller inner tubing strings, especially for tubingless completions. They can be supplied with either flanged or threaded connections.

15,000 psi Needle Valve — This valve has a one-piece forged steel body, Teflon packing, and stainless-steel needle.



Heater Choke — O·C·T's heater choke is designed to give you extra nose length in the heater fluid; acme-thread unions speed installation and removal; many parts are interchangeable with other O·C·T chokes.

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MONOETHANOLAMINE RECLAIMING

Part I. Operating Considerations

Reclaiming of monoethanolamine (MEA) solutions by semi-continuous batch distillation of a slip stream of hot lean MEA solution is accepted as an important part of the maintenance and care of MEA in gas-treating service. Most reclaimers are installed as an integral part of the amine-treating system. Occasionally a company has several small plants located in the same general area and will use portable reclaimers which can be moved from plant to plant as needed.

Contamination of ethanolamine solutions can be minimized by good operating practices and design, but it is extremely difficult to eliminate completely the formation of heat stable salts, degradation and decomposition products. It is possible to remove the majority of these undesirable compounds from the MEA solution by continuous reclaiming of a slip stream of the circulating solution. Reclaimers have the additional advantage of removing finely divided insoluble matter, not removed during filtration, as well as heavy oils which accumulate in the solution. Although fine particulate matter will be removed from the system via the reclaimer bottoms, the majority of the solids should be removed by filtration of the lean amine solution.

PROCESS FLOW

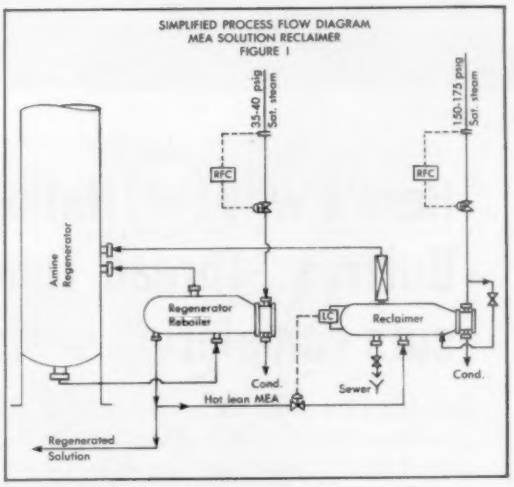
A simplified process flow diagram of a typical MEA reclaimer is shown in figure 1. Hot lean MEA from the regenerator reboiler is usually used as feed to the reclaimer to conserve heat. The reclaimer feed is usually controlled by a liquid level controller on the reclaimer kettle. Monoethanolamine and water vapors are flashed overhead in the reclaimer using 150-175 psig saturated steam as the heating medium.

At the start of each cycle most of the overhead vapor will be water. As the cycle progresses, the amine will become more concentrated in the reclaimer bottoms and the amine content of the overhead stream will increase. The temperature of the liquid in the reclaimer will increase as the solution becomes more concentrated in MEA and in compounds of higher boiling point than MEA. A maximum temperature of 290-300°F. is recommended since higher temperatures promote further degradation of the MEA and may result in co-distillation of undesirable materials in the overhead vapor along with the MEA.

The flashed vapors pass through a small packed column for removal of any entrained liquids. The reclaimer overhead stream, as shown in figure 1, is returned to the bottom of the regenerator column in most plants to recover the heat from the reclaiming operation. Condensation and return of the reclaimer overhead to the lean MEA stream is sometimes advisable when the vapor loading of the regenerator is critical.

Solids, sludge, heat stable salts, decomposition and degradation products accumulate in the reclaimer bottoms until the end of the reclaimer cycle when they are dumped.

SIMPLIFIED PROCESS FLOW DIAGRAM
MEA SOLUTION RECLAIMER
FIGURE 1



RECOVERY OF MEA FROM HEAT STABLE SALTS

Heat stable salts are formed when chemicals more acidic than H_2S or CO_2 come into contact with MEA. Typical of the materials which form heat stable salts are the thiocyanates, thiosulfates, formic acid, acetic acid, napthenic acids, sulfates, chlorides, etc. The addition of soda ash or caustic to the reclaimer at the beginning of each cycle will form the sodium salts of the above acidic impurities thus freeing the combined MEA. The use of a low chloride content soda ash such as natural soda ash or the use of a rayon or mercury cell grade caustic should be practiced where stainless steel is used to prevent chloride stress corrosion cracking.

For complete information on Jefferson glycols, ethanolamines, and helpful technical services . . . contact Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

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JEFFERSON CHEMICALS

088

The "OILWELL" string

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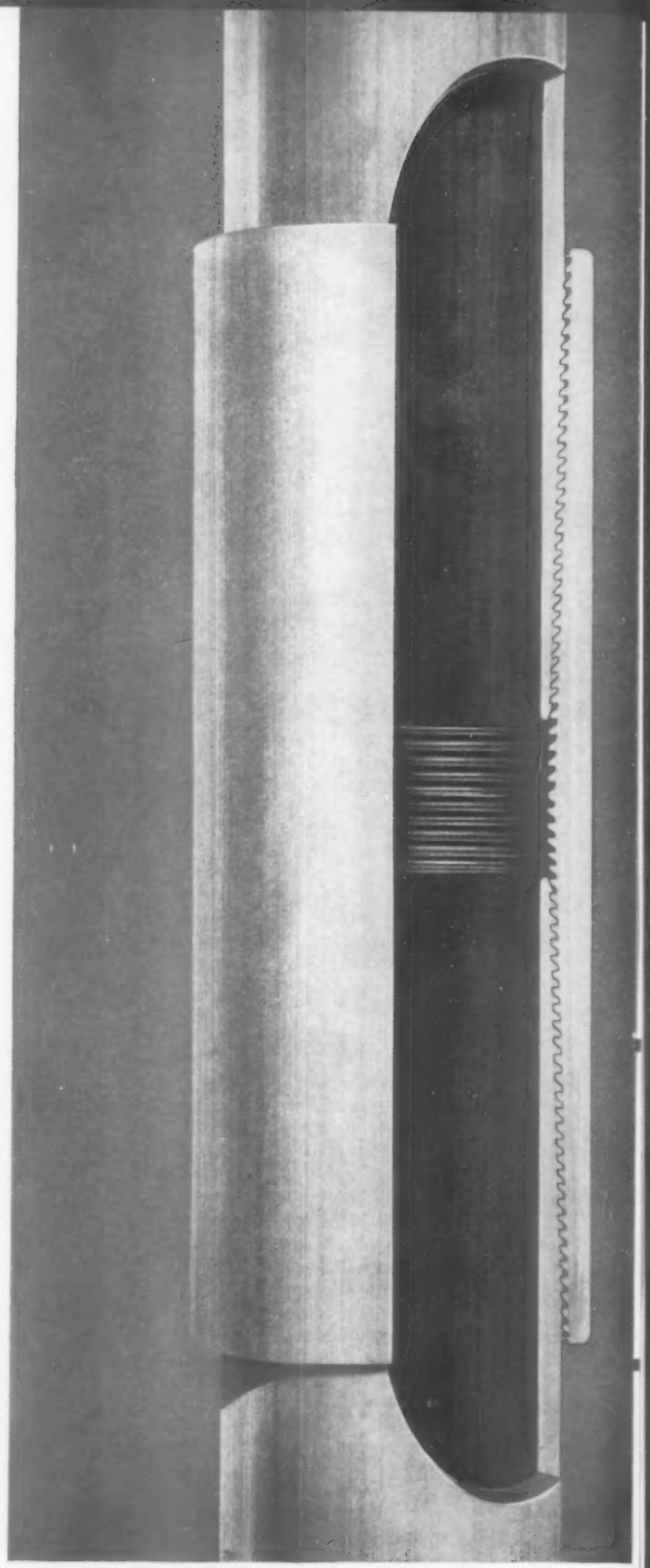
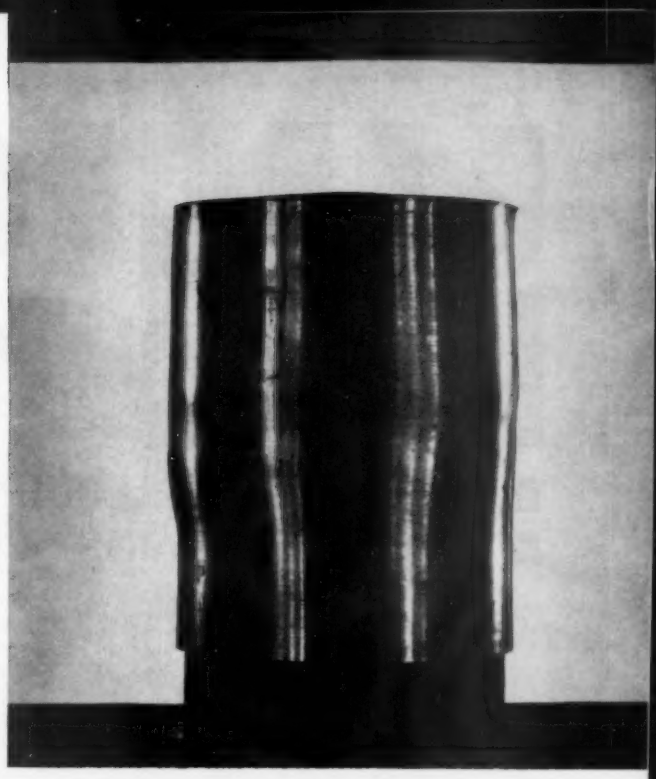
SERVICES
STORES

Here's why USS National Buttress-Thread Tubing cuts completion costs

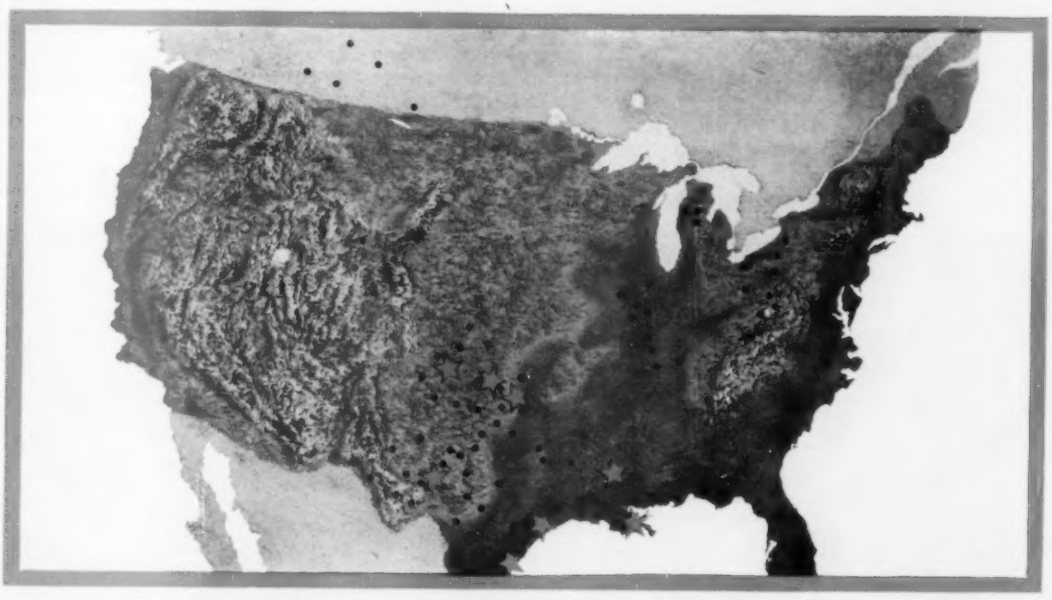
Newest word in the oil fields is the USS National Buttress-Thread joint. Especially where there's a trend to multiple completion wells and slim hole wells. Reason: the unique new thread eliminates the need for the internal upset in casing as well as the external upset in tubing. The result is maximum hole clearance, and you can run multiple tubing strings with minimum interference. Joint strength is comparable to the strength of the body of the pipe itself. Stabbing is simple and fast without thread damage or cross threading. The pipe slips easily into the coupling, engages immediately, and 2½ turns make it gas-tight. Heavy tin plating on the coupling threads eliminates gas leaks even at pressures as high as 15,000 psi. Best of all, unlike upset pipe, if Buttress-Thread ends are damaged you can repair them by cutting new threads right in the field. You get more use out of USS National Buttress-Thread Tubing in every way. Buy it through "Oilwell".





A tough test

The USS National Buttress-Thread joint was tortured worse before its introduction than it ever will be in normal service. For example, National Tube engineers rammed casing nipples into couplings until they tore the threads loose. Despite these brutal measures, the couplings didn't fail—the joint remained intact. Other mill tests showed that Buttress-Thread joints can be made up and broken at least 12 times without thread damage or impairment to joint performance. No matter what you buy from "Oilwell", you can be sure it's been tested seven ways to Sunday.



How to buy USS National Buttress-Thread Tubing

Order it through any "Oilwell" store or sales office. Stocks are maintained for fast delivery in Odessa, Corpus Christi, Houston, Harvey, Vidalia, Oklahoma City, Hennessey and Gray. The dots on the map show "Oilwell" stores, the stars indicate Buttress-Thread Tubing warehouse locations. Call us for immediate shipment. Or call us even if you just want to talk about USS National Buttress-Thread Tubing. We *like* to talk up its many cost-saving advantages.

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This means important savings through reduced downtime for maintenance and cleaning . . . lower power costs . . . longer equipment life. Its consistent use assures full flow capacity and safeguards product purity.

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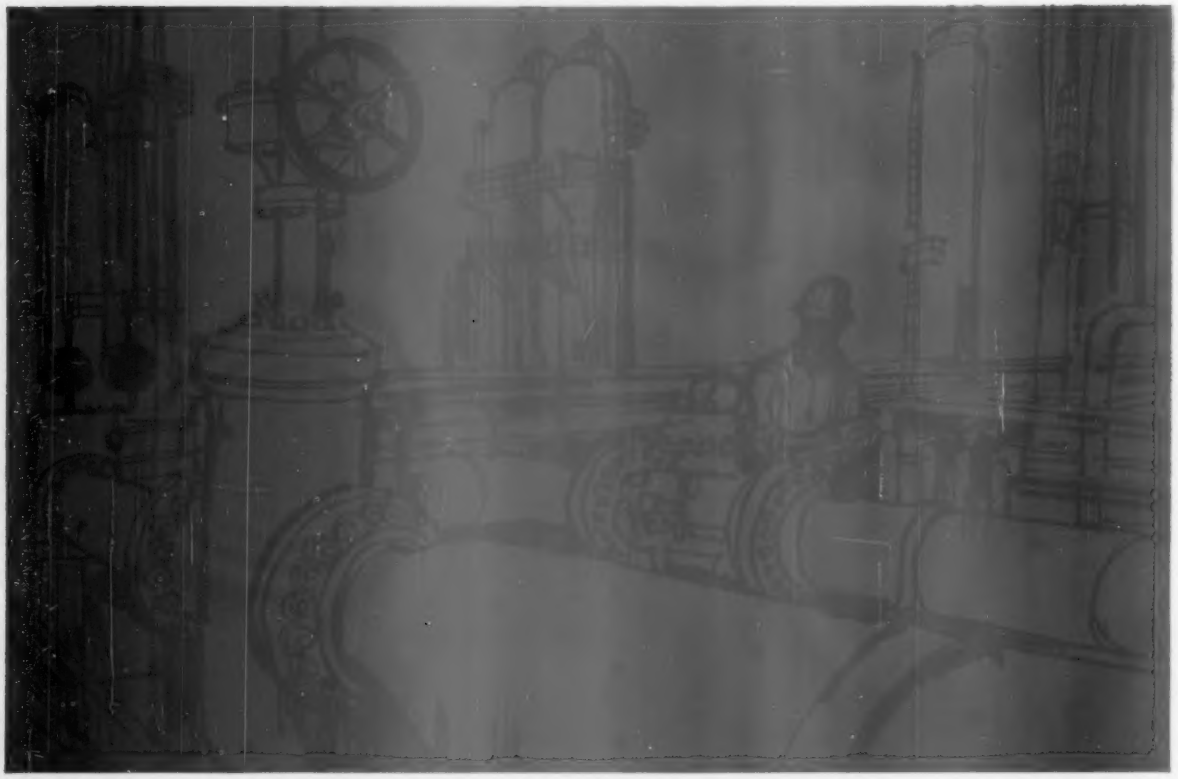

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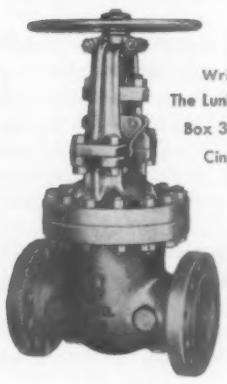

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CONTRACTOR "SIZES UP" NEW TD-15 AT FACTORY ...FIELD PERFORMANCE CONFIRMS JUDGMENT

Digging a pit with the new TD-15, operator Jim Hoyt uses fast Shuttle-Bar control for instant reversing to speed the cycle. The "15" is the only crawler in its power class with the shock-load prevention of ball-joint suspension—basic in International's 3-point track mounting design.

Seeing what goes into the TD-15 at International's famous Tractor Works convinced oilfield contractor, George Baize he'd get more out of this machine—in performance, long life, low upkeep. His 62-inch-gauge Oilfield Special TD-15 is equipped with the 8-foot outside push-arm hydraulic bulldozer. Big in work capacity, this rig is sized for easy highway haulage without special permits.

Oilfield Contractor George Baize, Hill City, Kansas, visited International's "Tractor Works" in Chicago—to size up new TD-15 advantages, first hand.

Mr. Baize noted the big tapered roller bearings that go into the new "15's" transmission; the transmission oil pump that circulates and filters lubricant for extra long gear life. He observed economy and long life features like the new sintered metal steering clutch discs with built-in heat-defiance; new dry-type air cleaner with transparent, quick-dump collector.

He examined advances that increase TD-15 undercarriage strength and life: new drum-type front idlers to team with famous, precision welded double-box beam track frames. New self-cleaning, power-saving strutless track links. Improved, high-

efficiency full-floating seals to protect the long life Dura Rollers—the track rollers you grease only once per hundred 10-hr. shifts!

Goes home and buys one!

And when Mr. Baize returned to Hill City, he bought a new International TD-15. He's putting his new TD-15 on the hardest jobs he can scare up—reports getting the perfect performance he needs to make money on them! And his operator Jim Hoyt says: "We try to cut our location work and pit-digging time with all our dozers—still I can beat our best (previous) time with this new International TD-15, because of its digging ability, power, and speed."

Prove TD-15 ability to top its power class in production, operating economy, and on-the-job dependability for toughest oilfield work. Try the new "15" equipped with outside push-arm hydraulic dozer—for digging pits, clearing sites, doing all kinds of location jobs. Let your International Construction Equipment Distributor demonstrate.

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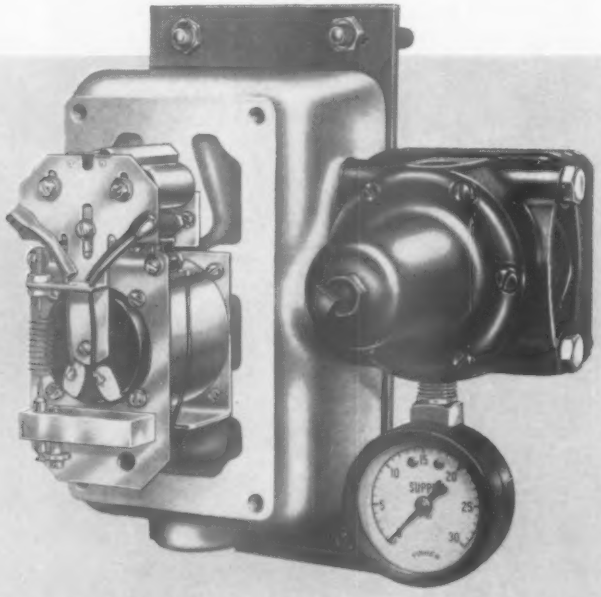
SPEED THE INPUT SIGNAL to the CONTROL VALVE



FISHER

TYPE 543

ELECTRO PNEUMATIC TRANSDUCER

Available with or without a pneumatic valve positioner

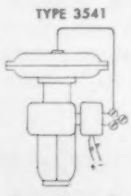
Here's an electro-pneumatic transducer developed for use in electrical control loops where the final control element is pneumatically operated. Explosion proof design makes it ideal for use under hazardous conditions. Input signals may range from 1 to 5 ma. through 10 to 50 ma. . . . output from 3 to 15 psi through 6 to 30 psi. Built-in volume relay permits direct operation of the pneumatic actuator from the Transducer. No extra relays or boosters needed. Relay can be serviced independent of electrical assembly. Unit is completely reversible by reversing input leads and rezeroing.

If you want additional information on the Type 543 Electro-Pneumatic Transducer write Fisher Governor Company.

TYPICAL CIRCUITS		
Input Current	Load Requirements of Controller	Actual Internal Resistance of Transducer
1 to 5 ma dc	3,000 ohms maximum	2,500 ohms ±125 ohms
1 to 5 ma dc	12,000 ohms ± .5%	12,000 ohms ± 50 ohms
10 to 50 ma dc	500 ohms maximum	57 ohms ± 4 ohms

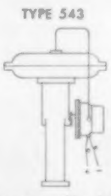
PERFORMANCE DATA	
Linearity	1% of full range
Air Consumption Rate	2 SCFH with 15 psi output pressure
Resolution Sensitivity	.05% of input range
Frequency Response	Complete frequency response data with Fisher topworks available

TYPE 3541



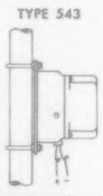
Electro Pneumatic Controller Mounted on Control Valve

TYPE 543



Transducer Mounted on Control Valve

TYPE 543



Transducer Mounted on Stand Pipe

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD . . . CHANCES ARE IT'S CONTROLLED BY . . .

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / London, England

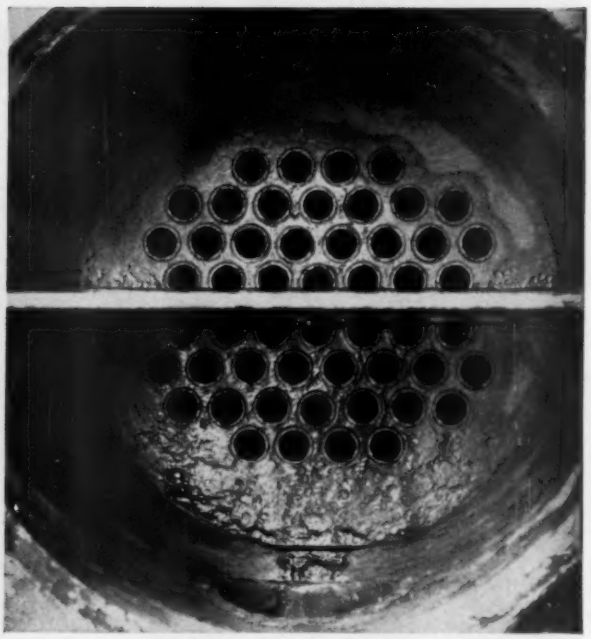
CONTINENTAL EQUIPMENT CO. DIVISION, Coraopolis, Pennsylvania

FISHER® Controls

SINCE 1880

Descale equipment quickly, safely —without dismantling!

BEFORE—This condenser was badly clogged with hard-water scale. Mechanical cleaning of the tubes would have been difficult, time-consuming and costly. To use hydrochloric acid would pose danger to nearby equipment and personnel.



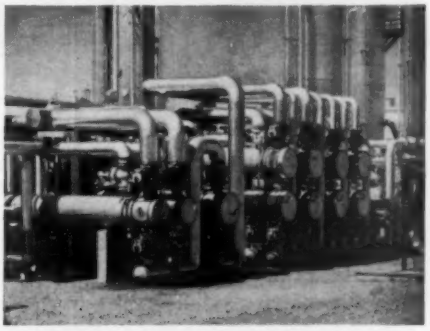
AFTER—It was easily cleaned *without dismantling* by circulating a water solution of a sulfamic acid-based cleaner for an hour. Short downtime, *no* danger to equipment and complete safety for personnel!

Use a dry-acid cleaner based on Du Pont Sulfamic Acid

They're effective. Dry-acid cleaners dissolve most water-side deposits found in condensers, boilers, compressor jackets, heat exchangers, etc. Yet they're much less corrosive to metal than hydrochloric-acid cleaners.

They're easy, safe. Just dissolve the solid cleaner in water and circulate through the equipment. No danger of broken carboys, spilled liquids or toxic fumes—glasses and gloves are the only protective clothing needed!

They're economical, fast. 1 lb. of dry cleaner does the job of 1.3 lb. of 28% hydrochloric acid—you save on shipping, handling, storage and downtime (because there's no dismantling).



Various types of refinery equipment, like these heat exchangers, are easily descaled with a cleaner based on Du Pont Sulfamic Acid. The equipment is cleaned *in place* with a minimum of downtime.

Ask your water-treatment company's technical representative about dry-acid cleaners; chances are, he can supply you. Or send the coupon for booklet and names of formulators offering dry-acid cleaners based on Du Pont Sulfamic Acid.

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Industrial and Biochemicals Department, N-2545OG
Wilmington 98, Delaware

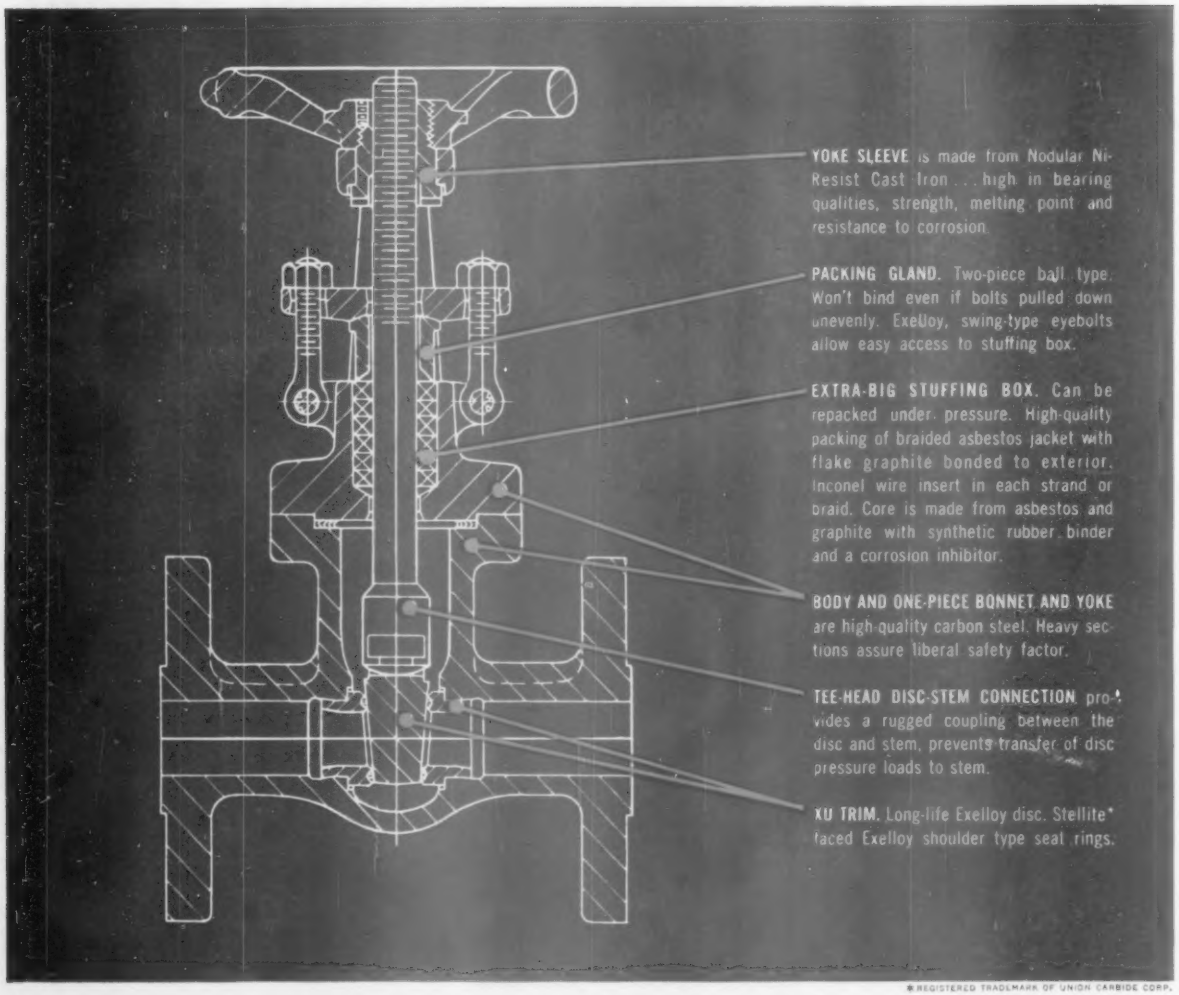
Please send your "Descale" booklet and names of formulators offering cleaners based on sulfamic acid.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *State*_____


YOKE SLEEVE is made from Nodular Ni-Resist Cast Iron . . . high in bearing qualities, strength, melting point and resistance to corrosion.
PACKING GLAND. Two-piece ball type. Won't bind even if bolts pulled down unevenly. Exelloy, swing-type eyebolts allow easy access to stuffing box.
EXTRA-BIG STUFFING BOX. Can be repacked under pressure. High-quality packing of braided asbestos jacket with flake graphite bonded to exterior. Inconel wire insert in each strand or braid. Core is made from asbestos and graphite with synthetic rubber binder and a corrosion inhibitor.
BODY AND ONE-PIECE BONNET AND YOKE are high-quality carbon steel. Heavy sections assure liberal safety factor.
TEE-HEAD DISC-STEM CONNECTION provides a rugged coupling between the disc and stem, prevents transfer of disc pressure loads to stem.
XU TRIM. Long-life Exelloy disc. Stellite* faced Exelloy shoulder type seat rings.

*REGISTERED TRADEMARK OF UNION CARBIDE CORP.

Crane adds flanged 150 & 300-pound steel gate valves to famous 3600 series.

Gives you a complete line of Small Steel Gate Valves suitable for all services at temperatures up to 1000 F. Available in sizes ½" to 2". Gives you design refinements generally associated only with higher priced valves.

The drawing illustrates only a few of the important features of these superior valves. There is built-in quality and reliability in every detail. Outside screw and yoke ruggedly constructed. Stem is heat treated Crane Exelloy. Bonnet joint gasket of spiral wound, Type 316 stainless steel with asbestos filler.

The cast steel 150 & 300-pound valves have "XU" trim and flanged ends (face-to-face conforms to ASA B — 16. 10) . . . figure numbers 3510XU (150 pound) and 3514XU (300 pound).

With the addition of these new valves to the 3600 Series, Crane now offers you the industry's finest choice of quality, small steel valves. All of them are ideally suited for use with steam, water, air, gas, oil, oil vapor, gasoline, fuel oil and similar services.

More details from your Crane distributor. Or write to Crane Co., Dept. G, Industrial Products Group, 4100 South Kedzie Ave., Chicago 32, Ill. In Canada: Crane Ltd., 1170 Beaver Hall Square, Montreal.

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HEART
OF HOME AND
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HEATING • AIR CONDITIONING

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WIDEST POSSIBLE RANGE OF SIZES AND CAPACITIES — UNBEATABLE MCKISSICK CONSTRUCTION —

EXTRA HEADROOM, SHORT OVER-ALL LENGTH. CENTER PLATES BE-TWEEN EACH SHEAVE.

EXTRA WEIGHT FOR BALANCE . . . JOHNS-MANVILLE "KLIPPER" GREASE SEALS.

EXTRA LARGE BEARING DIAMETER, E-Z OPENING GUARDS. NO BOLTS TO REMOVE. 17" TO 42". O. D. ALLOY STEEL FLAME HARDENED SHEAVES. BUILT IN "BUMPER".

Be Specific . . .
Get McKissick!

McKISSICK

McKISSICK PRODUCTS CORPORATION
Box 2496 Tulsa, Oklahoma

ROCK ISLAND

GLASS REINFORCED EPOXY PIPE AND TUBING

BEST

BECAUSE IT'S

PRE-STRESSED

This significant development (similar to pre-stressing concrete) places the load on the *glass* — rather than the epoxy resin — through pre-stressing thousands of strands of alternate plies of lateral and longitudinal glass roving. Consequently, Rock Island's new glass/reinforced epoxy pipe and tubing is rugged and practical for use in oil fields.

Pre-stressing develops maximum collapse and tensile strength, making the tubing ideal for high-pressure injection wells. Rock Island 2½" high-pressure tubing is built to withstand pressures up to 1,500 p. s. i. Upset ends are fabricated into the tubing during manufacture for maximum strength. Regular chain tongs may be used in making up joints . . . tubing can be handled in doubles . . . and tubing strings can be suspended on slips. Joints are threaded and coupled with standard AST 60° stub threads.

Thousands of feet of this new tubing (in 20-foot lengths of 2½", 3", and 4" I.D.) are proving highly effective under conditions that call for severe corrosion and paraffin control; and under conditions requiring high pulsating pressure. It is proving equally effective in chemical industry uses for handling corrosive fluid and waste water disposal.

Rock Island glass/reinforced epoxy line pipe is performing in mid-continent oil fields to a high degree of satisfaction in salt water disposal and water flood systems as low-pressure pipe

COMPARATIVE SPECIFICATIONS		
2½" Medium Weight Tubing		
	ROCK ISLAND GLASS-EPOXY	OTHER
Wall Thickness	.15	.15
Operating Pressure	520 p.s.i./120°	275 p.s.i./120°
Operating Collapse	330 p.s.i./120°	80 p.s.i./120°
Operating Axial Tensile	6,060 p.s.i./120°	2,000 p.s.i./120°
2½" High Pressure Tubing		
Wall Thickness	.22	.26
Operating Pressure	1,500 p.s.i./120°	650 p.s.i./120°
Operating Collapse	750 p.s.i./120°	500 p.s.i./120°
Operating Axial Tensile	10,000 p.s.i./120°	5,000 p.s.i./120°

in 2", 2½", 3", and 4" I.D. sizes. Dresser-type couplings may be used. Adaptors are available for 8 round E.U.E. and normal pipe thread.

At the present time, Rock Island pipe and tubing is available in 2", 2½", 3", and 4" sizes. On special order, 6", 8", and 10" line pipe (20-foot lengths) will be fabricated to user's specifications. Future production calls for larger sizes to 30" in diameter. Contact us for detailed specifications: Rock Island Oil & Refining Co., Inc., 321 West Douglas Ave., Wichita, Kansas. Phone: WHitehall 3-8981.

ROCK ISLAND

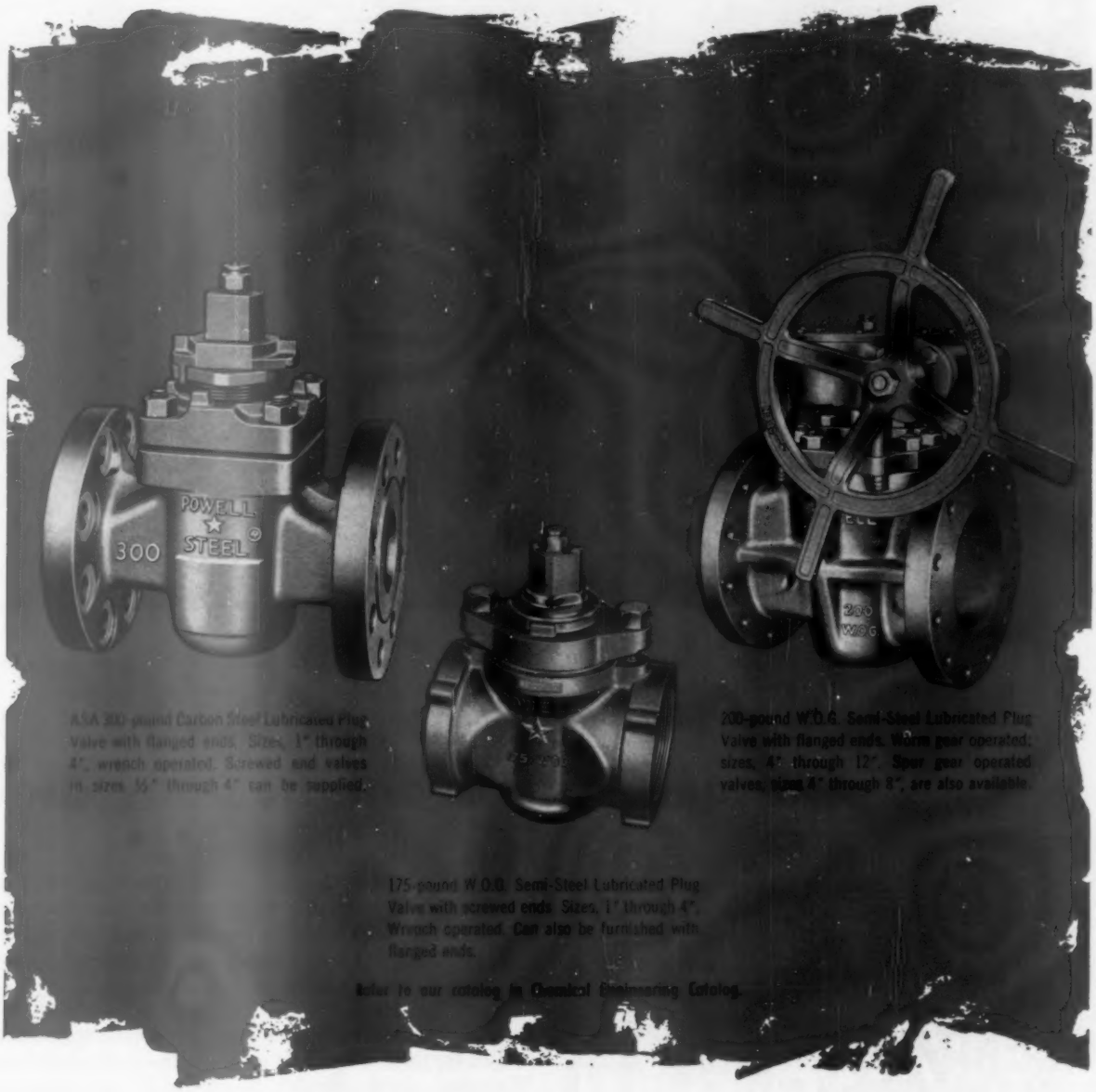
POWELL PERFORMANCE PAYS OFF

It is a matter of record, in refineries everywhere, that Powell valve performance really is paying off.

And equally important is the fact that whether you need valves to control the flow of water, oil, gas, air, steam or corrosive fluids—available in steel, bronze, iron or alloys—Powell has them.

You'll find every Powell valve is designed by engineers long experienced with the industry's valve requirements . . . and built by craftsmen who take pride making a valve you can count on.

So, by filling your flow control needs quickly, with truly reliable valves from one source of supply, you too, can be sure of valve performance that will pay off. For further information or assistance with special problems, contact your nearby Powell valve distributor or write The Wm. Powell Company, Cincinnati 22, Ohio.



ASA 300-pound Carbon Steel Lubricated Plug Valve with flanged ends. Sizes, 1" through 4", wrench operated. Screwed end valves in sizes ½" through 4" can be supplied.

175-pound W.O.G. Semi-Steel Lubricated Plug Valve with screwed ends. Sizes, 1" through 4". Wrench operated. Can also be furnished with flanged ends.

Refer to our catalog in Chemical Engineering Catalog.

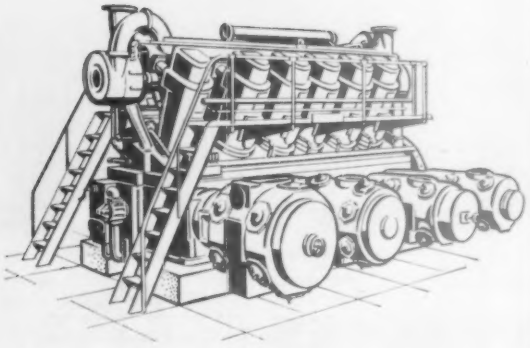
200-pound W.O.G. Semi-Steel Lubricated Plug Valve with flanged ends. Worm gear operated; sizes, 4" through 12". Spur gear operated valves, sizes 4" through 8", are also available.

115th year of manufacturing industrial valves for the free world

POWELL PETROLEUM **VALVES**

THE WM. POWELL COMPANY CINCINNATI 22, OHIO

"MAMMOTHS and MICROMETERS"—



A 150-ton turbocharged gas engine, or a quarter-ounce leaf spring for a Channel Valve — both are made with the same perfection of detail at Ingersoll-Rand's newly-expanded gas-engine compressor plant at Painted Post, N. Y.

No component is too large or small to get the full treatment of Ingersoll-Rand's exacting quality control, from foundry to assembly floor. Usually it's the "tremendous trifles" that lead to troubles

Quality is maintained by careful inspection at each stage of manufacture. Here, Channel Valve springs are being checked for correct tension.

In the Painted Post foundry, alloy steel of special formulation is poured into molds for compressor cylinders.

Optical glass and ultra-violet light rays check hyper-pressure compressor valves for absolute flatness.

extra precision builds longer life into your engine-compressors

in the field. But here at Painted Post, nothing is taken for granted — every item is checked and double-checked. Every detail must meet I-R standards of quality and performance, for any machine is only as dependable as its weakest part.

The Painted Post plant is the largest and most modern engine-compressor manufacturing facility in the world. Your Ingersoll-Rand engineer will be glad to arrange a factory tour so you can see for yourself the extra precision built into every I-R 4-cycle V-angle engine-compressor — from the 120-hp JVG to the 4500-hp KVH.

Ingersoll-Rand

240A6 11 Broadway, New York 4, N. Y.

The World's Most Comprehensive Compressor Experience

What Really Happens Inside the Bucket

Exploding a widespread misconception of the operation of inverted bucket steam traps

In describing the operation of the inverted bucket trap many well meaning people—and some not so well meaning; i.e., competitors—refer to the need for a "bucket full of steam" to close the trap, and a "bucket full of condensate" to open the trap. The implications of these requirements are many. Sometimes they are contradictory. Often they are misleading. Observations of a trap with a glass body and a glass bucket plus trap design considerations tell the true story.

* * *

In a well designed inverted bucket trap (Armstrong, naturally) the bucket will float and close the valve when it is *no more than two-thirds full of steam.* For example, the bucket in an Armstrong No. 812 trap is $3^{15}/_{16}$" deep. It will float with only 2" of steam.

Good design also dictates that the maximum test opening pressure of a trap should be well in excess of the maximum working pressure for which the trap is furnished. For example a No. 812 trap for 100 psi with the bucket filled with cold water should open at a test pressure of at least 165 psi. Therefore, the bucket does not have to fill completely with condensate to open at 100 psi. The entrance of 1.20" of condensate will cause the bucket to sink. .8" of steam remains at the top of the bucket at the time it is heavy enough to open the valve at 100 psig and with no back pressure.

Thus the opening and closing of a 100 psi trap with $3^{15}/_{16}$" deep bucket is controlled by a change in the water level of only 1.20".

In actual practice the 100 psi trap may be draining a steam main in which daytime pressure is only 30 psig. Instead of requiring a 1.20" rise in bucket water level to open the trap against this pressure, the bucket will be heavy enough to open the valve as soon as the water level in the bucket has risen about $^3/_{16}$".

Obviously, it does not "take a bucket full of steam" to close the inverted bucket trap, or a "bucket full of condensate" to open the trap.

What's the Significance?

As illustrated above the opening of an Armstrong Trap requires the accumulation in the trap of less than one-third of a bucket full of condensate. This assures good operating characteristics for the vast majority of services by discharging small accumulations of condensate as soon as they reach the trap. It also assures frequent opening pressure drops to break up air and condensate films on heat transfer surfaces and thereby maintain high heat transfer rates in the unit being drained.

Additionally, the fact that no more than two-thirds of a bucket of steam is required to float the bucket means that there will always be a generous water seal at the bottom of the bucket. In the case of the No. 812 trap described above, it will be 1.8" deep. This insures that no steam can leak from the bottom of the bucket. More importantly, the bucket can float to close the valve even when the bucket is not completely submerged in condensate.

A Proven Principle Engineered Up to the Minute

While the inverted bucket concept for steam traps is half a century old, today's Armstrong inverted bucket traps incorporate design considerations unknown 50 years ago. The inverted bucket of the Armstrong trap, for example, is not just an upside down bucket. It is a carefully sized, weighted and vented component of a steam trap mechanism that experience proves will do its job right. Throughout, Armstrong design has kept pace with technological advancements, modified when necessary to meet changing requirements.

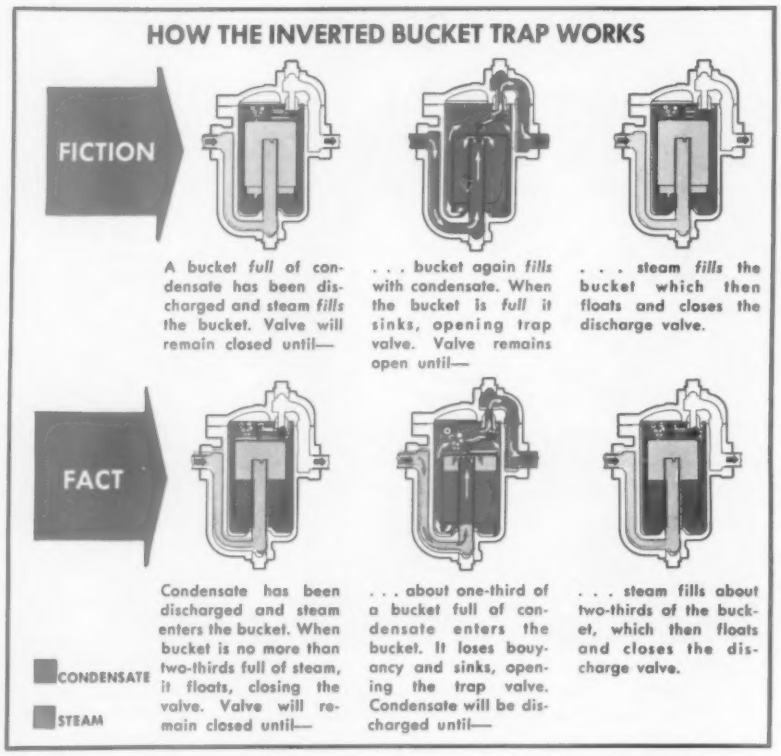
We do not claim that Armstrong Traps will do every single job better than any other trap. But we do believe it will do more jobs better and more consistently than any other trap. More important, though, for most services, Armstrong Inverted Bucket Steam Traps enable you to get more efficient steam utilization with minimum problems.

We're so sure of what Armstrong Traps can do that we unconditionally guarantee that they will satisfy you. You are the sole judge, too, so there's practically no risk.

* * *

The 48 page Armstrong Steam Trap Book describes other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write: **Armstrong Machine Works, 8687 Maple Street, Three Rivers, Michigan.**

ARMSTRONG STEAM TRAPS

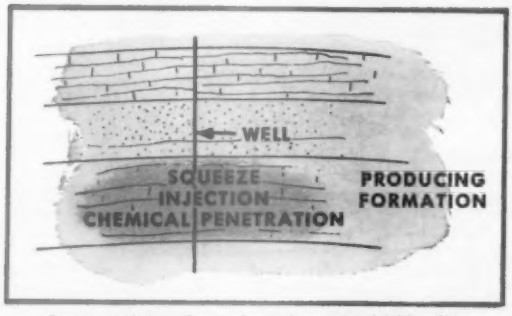

HOW THE INVERTED BUCKET TRAP WORKS
FICTION
A bucket full of condensate has been discharged and steam fills the bucket. Valve will remain closed until—
. . . bucket again fills with condensate. When the bucket is full it sinks, opening trap valve. Valve remains open until—
. . . steam fills the bucket which then floats and closes the discharge valve.
FACT
Condensate has been discharged and steam enters the bucket. When bucket is no more than two-thirds full of steam, it floats, closing the valve. Valve will remain closed until—
. . . about one-third of a bucket full of condensate enters the bucket. It loses bouyancy and sinks, opening the trap valve. Condensate will be discharged until—
. . . steam fills about two-thirds of the bucket, which then floats and closes the discharge valve.
CONDENSATE
STEAM

Visco Squeeze Treatment Chemicals Designed to Fit Varying Well Conditions

Corrosion Control Lasts, Costs Less with New Visco Formulas, Methods

Squeeze treatment in producing wells continues to grow in importance as an economical, long-term method of obtaining effective corrosion control. It is simply the pressure injection of corrosion inhibitor chemical into the producing formation, from which it is released in approximate proportion to produced fluid volume over a period of time—anywhere from two to sixteen months.

Visco has found squeeze treating of sufficient interest to producers to justify development of specialized chemicals and techniques to permit most effective use of the method.



Squeeze technique forces chemical corrosion inhibitor into formation around well bottom. Chemical is carried back with produced fluid. The excellent film persistency of Visco squeeze treating chemicals assures long-lasting, low-cost well protection.

Effects of Formation

Producing formation composition, porosity permeability and position can have an important bearing on the success of squeeze treatment corrosion control . . . They are important considerations in the development of special Visco formulas for this purpose.

Determining Chemical Type

As with any operation affecting producing formations, experience is the most dependable guide. Chances are great that the conditions you have in your area have been closely paralleled by other Visco squeeze treating experience. Further, Visco Formulas such as

Visco's P. H. Mallette, Product Manager for Corrosion Control Chemicals, discusses factors considered important in assuring effective squeeze treatment.

new 939, 956, and 990, were developed to broaden the effectiveness of corrosion control with squeeze treatment, and so are a big help in pinpointing the best chemical and method to apply to specific well characteristics.

Field Experience

Squeeze treating can offer some substantial cost and time advantages for effective corrosion control in many types of producing wells . . . BUT, probably more than any other treating method, squeeze treatment demands skill and experience, as well as effective chemicals, to assure success. No one is better equipped than Visco . . . *we* firmly believe no one else can do as well for you.

Help, Now

Visco action toward being useful in your activities is as close as your phone—and nearly as quick as picking it up. Your move.

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A subsidiary of Nalco Chemical Company
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Better Production Tools Through Research

OTIS Equipment NEWS

Volume III, Number 3 **Otis Engineering Corporation • Dallas** *Production Equipment and Services*

Now...An Otis Flow Line Safety Valve And Pilot For Only $295.00

Proven Otis Safety Valve Design Costs Less Than Many "Substitute" Safety Devices

DALLAS—An all new flow line safety valve employing the time-proven Otis Safety Valve design is now available for installation on wells requiring shut-in protection in the event of flow line breakage. The new valve, designated the Type K Otis Flow Line Safety Valve, may be purchased in the popular 2-inch, 3,000 p.s.i. screw-end size complete with a new Type BE Otis Low Limit Pilot for $295. The Type K Valve is also available with flange-end connections at slightly higher cost. The valve and pilot are designed to automatically shut in a well when flow line pressure drops below the pre-set limit of the pilot. The pressure drop may be due to a break in the flow line itself or the malfunction of auxiliary equipment downstream of the valve. The new Type K Valve and BE Pilot combination offers oil and gas producers effective Otis Safety Valve protection at a new low price — a price which in many cases is lower than that of substitute safety devices such as diaphragm - operated motor valves, etc.

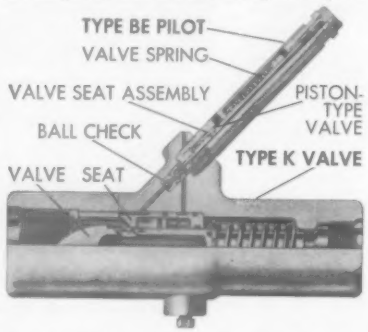
PRICES — TYPE K VALVE AND BE PILOT COMBINATION

Size — Type End	Working Pressure Rating (p.s.i.)	Price
2" — Screw	3,000	$295.00
2" — Screw	5,000	335.00
2" — Flange	3,000	345.00
2" — Flange	5,000	385.00

Note: Be sure to specify pressure range for pilot.

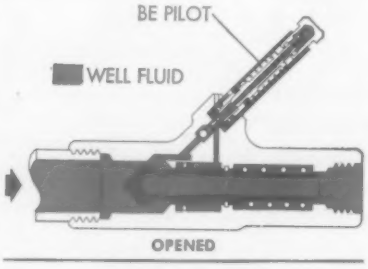
Valve Operating Principles

The Type K Otis Flow Line Safety Valve is a pilot-controlled pressure-operated safety valve designed to automatically shut in a well in the event of abnormal changes in pressure on the flow line or when control pressure from an external source rises above or falls below that for which the pilot is set. On installations where pressure from within the flow line is to serve as the pilot control medium (see schematic drawings), flow line pressure is equalized across the valve and the pilot to permit a spring in the safety valve to hold the valve piston off seat. When pressure within the flow line falls below the set pressure of the pilot, the pilot is designed to exhaust the pressure from behind the valve piston. This action serves to create a differential across the valve and allow flow to close the valve instantaneously. The valve is designed to be reopened by screwing in the nut on the pilot which acts to force the ball check in the pilot boss off seat to equalize pressure across the valve. When installed with the Type BE pilot, the valve serves to provide low-pressure protection. If both high and low pressure protection is desired, the Type E Otis Pilot is recommended. For remote protection, the Type N & P Otis Pilot combination is available.

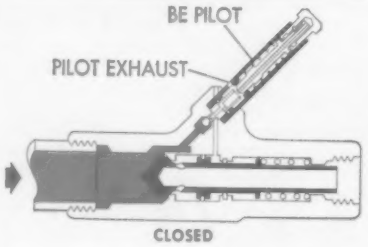


Pilot Operating Principles

The Type BE Low Limit Pilot is a spring-loaded, pressure-actuated control pilot designed to actuate the Type K Otis Flow Line Safety Valve in the event of a drop in flow line pressure below the preset limit of the pilot. The pilot consists of a body, a piston-type valve and valve seat, and a valve spring. When installed on a Type K Valve, a port in the safety valve body, the pilot seat assembly, and the pilot valve serves to admit flow line pressure to the pilot. This pressure acts to hold the pilot valve on seat against the force of the valve spring. In the event of a pressure drop across the valve and pilot, the spring within the pilot is designed to force the pilot valve off seat, permitting the pilot seat assembly to move up so that the ball check in the safety valve boss can seat. This action serves to exhaust pressure within the valve, create a pressure differential across the valve and permit the valve to close.



OPENED



CLOSED

Valve and Pilot Design Advantages

Both the Type K Otis Flow Line Safety Valve and the Type BE Otis Low Limit Pilot are of the simplest design and construction to provide reliable and positive operation. The flow path through the Type K Otis Flow Line Safety Valve has been engineered to permit high flow volumes with a minimum pressure drop. The valve was also designed with no small ports or natural body traps to avoid areas in which hydrates and/or paraffin might accumulate to foul the valve's operation. Both the valve and pilot are so designed as to permit each to be used with other Otis Safety Equipment.

Otis Surface Safety Valves and Pilots have long been recognized as the very finest. Otis Safety Valve Specialists have earned the same enviable reputation. Whatever your well safety valve requirements, Otis can be of help. For more information on Otis Safety Equipment, or for help with a specific safety valve installation problem, call the Otis office nearest you, or write Otis, Dept. 3-E, P.O. Box 35206, Dallas 35, Texas. You'll find experienced Otis Safety Valve Specialists ready to help you — anxious to serve you . . . with the widest variety of field-proven safety valves and pilots available today.

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what services?

The technical, training and marketing services that this tankcar represents are a bonus that users of DuPont antiknocks find as valuable to them as the antiknocks are to their gasolines. Helping you profit from these services is another practical advantage of doing business with DuPont.

E. I. duPont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

ANTIKNOCKS and other PETROLEUM ADDITIVES

DUPONT

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sharper view of
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This new, deep-penetrating Engineering Analysis facilitates computation of hydro-dynamics, provides indicated permeability and presents an analysis of well bore damage.

At modest cost, this comprehensive report will relieve your engineering staff of laborious detail work. You will find **Insight Analysis** invaluable in avoiding the risk of passing up a producer.

For more information about this new service, call Johnston Testers in your area, or write:

A WORLD OF EXPERIENCE

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HOUSTON, TEXAS
CALGARY, CANADA

How C-B/S Compressor Designs Solve Your Problems in Gas Gathering

Whether your problem revolves around fine compressor balance for barge-mounted operations, remote control or split gas streams, C-B/Southern people understand your needs. Their application experience is coupled with actual oil and gas producing background. That is why they can provide you with on-the-spot suggestions to economically solve your toughest gas gathering problem. This background is enhanced by company knowledge gained in building more than 40,000 compressor horsepower last year.

C-B/Southern's experience extends through Design, Engineering and Manufacturing Departments. It reaches all the way to future service from 22 Cooper-Bessemer service offices.

A point worth remembering: C-B/S packaged compressor plants are available in horsepower ratings from 100 to 1440; unitized compressors, both reciprocating and centrifugal, to 10,500 horsepower.

CB/S

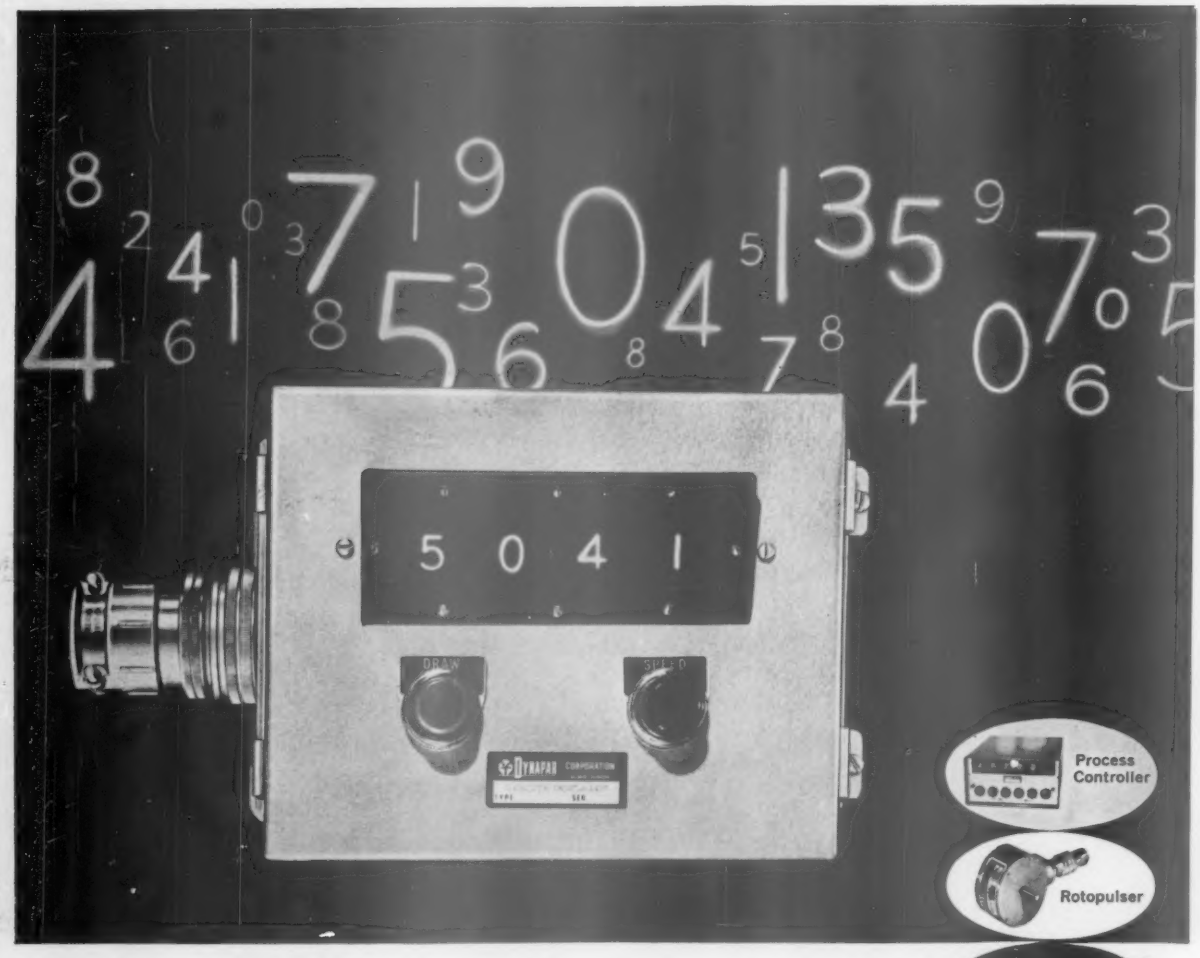
PACKAGED COMPRESSORS

CB/S

C-B/Southern, P. O. Box 19267, Houston 24, Texas • HOmestead 8-5441

A division of The Cooper-Bessemer Corporation

MANUFACTURERS OF PACKAGED COMPRESSOR PLANTS FOR GAS GATHERING, GAS LIFT, GAS INJECTION APPLICATIONS



NOW...Louis Allis offers DYNAPAR* Digital Control Systems!

Louis Allis can supply accurate digital controls designed to industrial standards for a wide variety of continuous process lines

For any production process, Louis Allis can furnish not only motors, drives, and controls, but also digital monitoring equipment to provide visual readout and process control signals.

The answer is DYNAPAR Digital Control — a highly accurate digital logic system that can count, measure, totalize, indicate, time, or control depending on the requirements of the application. Digital systems are ideally suited for high speed counting — accurate measurement of speed and draw — automatic cutting-to-length — automatic positioning — and many other applications.

Dynapar's digital devices utilize precise pulses, and eliminate the drift inaccuracy inherent in magnitude-measuring analog systems. There's no need for constant calibration or adjustment. Pulses are reliably provided by rugged ROTOPULSERS, highly stable sensing and pulse generating devices—visual indication is obtained by easily-read luminous direct numerical readouts. Control functions are accomplished by a variety of special devices tailored to specific operations. All DYNAPAR equipment features the most modern solid-state transistorized circuitry to provide long-life operation without maintenance.

Investigate to see how Louis Allis-Dynapar equipment can increase production and cut waste by automating *your* process. Call your local Louis Allis District Office, or write to The Louis Allis Co., 449 E. Stewart Street, Milwaukee 1, Wisconsin.

*Dynapar Corporation is the electronic subsidiary of The Louis Allis Co.

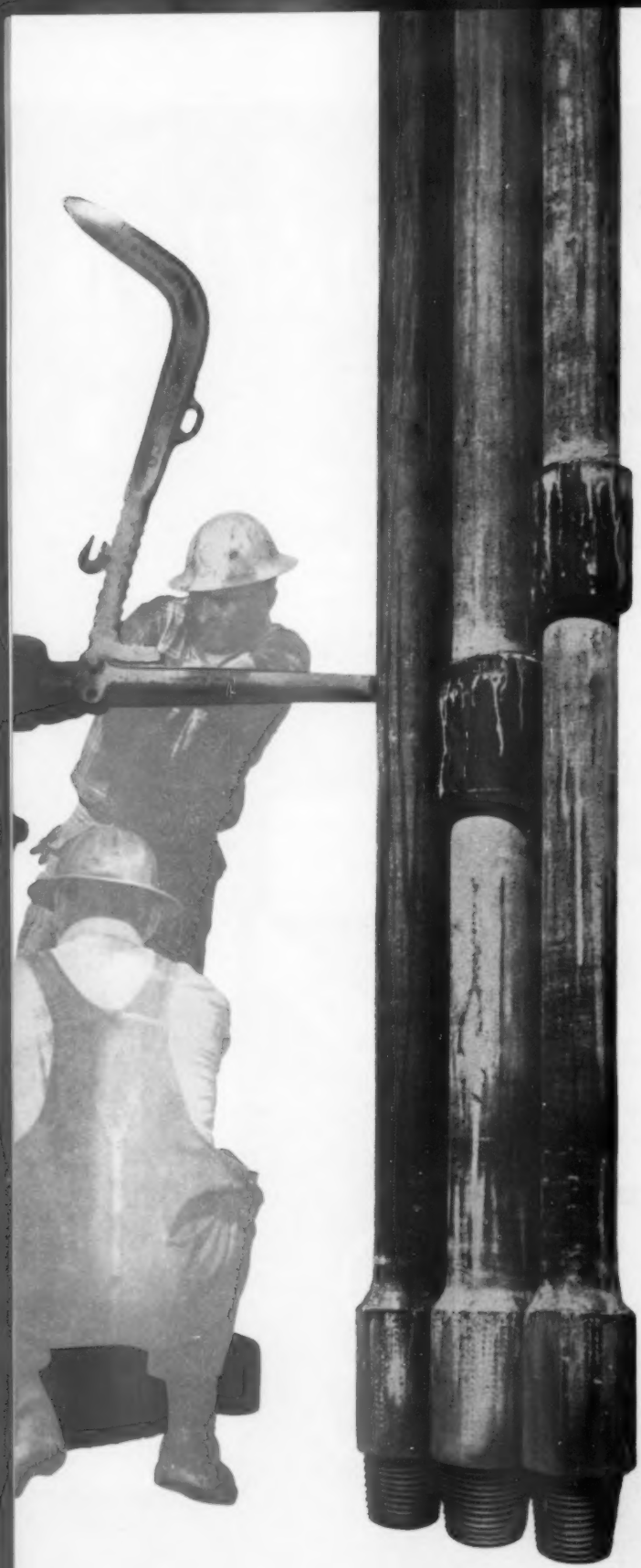
LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

B-226

World's first nuclear-powered commercial vessel, N. S. Savannah, to be lubricated by Texaco. States Marine Lines, operators of the vessel after her commissioning early in 1962, have awarded the lubrication contract to Texaco—and for good reason. Extensive study of the Savannah's lubrication demands was conducted by Texaco's million-dollar radiation laboratory—the most fully-equipped, privately-financed research facility of its kind in the oil industry. These studies proved the ability of Texaco Marine Lubricants to withstand radiation. Striking evidence of Texaco product performance, this is also evidence of Texaco's many diversified investments in providing oil for energy for the Free World.

TEXACO: SYMBOL OF WORLD-WIDE PROGRESS THROUGH PETROLEUM

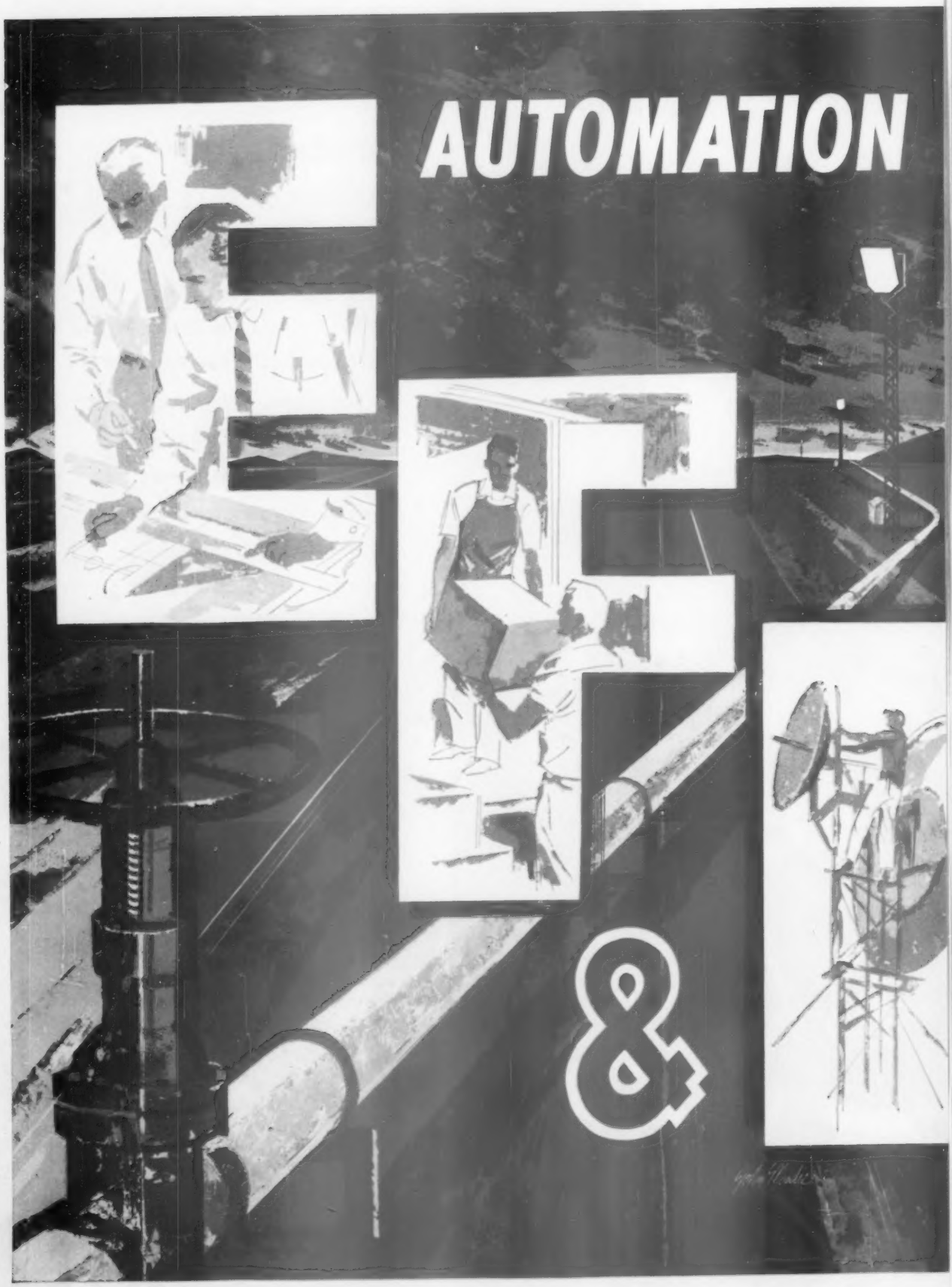


SUCCESSFUL COMING OUT PARTY!

It's successful because it goes strictly according to plan. Up comes over 8000 feet of J&L Seamless Drill Pipe to make a perfect trip. What happened here—what the picture shows—is normal, routine, planned, and always important. A professional crew **expects** a trouble-free trip . . . **expects** drill pipe to come out of the hole in good shape. Ask around. J&L Drill Pipe has a reputation for meeting your best expectations. The reputation has been earned the hard way—in action—on countless drilling jobs. J&L Casing and Tubing have the same top reputation for quality. Reason: J&L has invested millions in the best tubular production and testing equipment known. Talk performance and value with your J&L salesman soon.

Jones & Laughlin Steel Corporation
3 Gateway Center, Pittsburgh 30, Penna.

J&L STEEL


AUTOMATION
&

THROUGH COMMUNICATIONS

Engineered, Furnished and Installed to meet the needs of pipelines

If you're considering the cost-cutting advantages of *automation through communications*, it will pay you to consult with Lenkurt Electric.

As a leading specialist in microwave and carrier communications, Lenkurt Electric has the experience, capability, facilities, and resources to deliver a complete system installation from start to finish.

Lenkurt's EF&I service can save you time, money and manpower, because a Lenkurt EF&I team takes on full responsibility for everything—organization, direction, procurement and installation, right down to the last detail.

Before investing in microwave or carrier, ask for full information on Lenkurt Electric's customer services. A letter or phone call to the regional office nearest you will bring quick results.

Lenkurt Electric Co., Inc., San Carlos, California. Offices in Atlanta, Chicago, Dallas, Minneapolis, New York and San Carlos.

LENKURT ELECTRIC

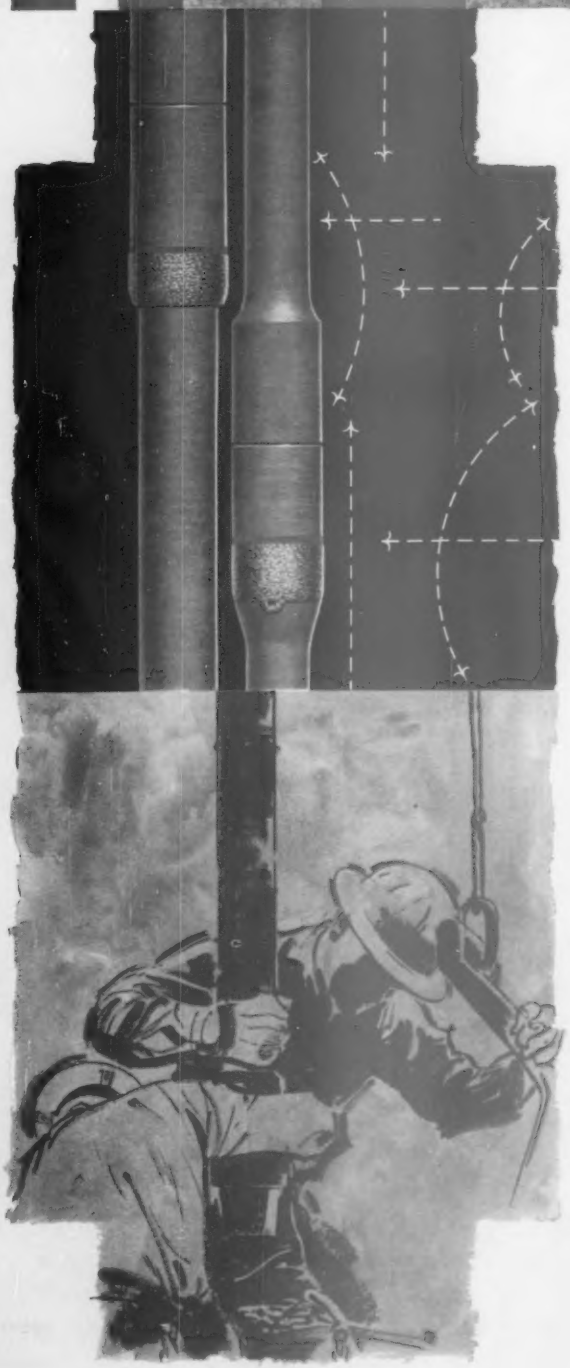
Subsidiary of

GENERAL TELEPHONE & ELECTRONICS

GENERAL SYSTEM

Specialists in VIDEO, VOICE and DATA TRANSMISSION

REED



Reed has contributed most to the design of the modern drill string!

Look at your drill string today, every one of the most popular A.P.I. tool joint connections on it was designed by Reed ■ Reed designed and developed the Full Hole Joint (now A.P.I. standard)—the Internal Flush Joint (now A.P.I. standard)—the Extra Hole Joint—the Super Shrink Grip Tool Joint (the first, best, most foolproof tool joint on the market today)—the tensile impact test for checking flash welds (there has never been a field failure in the weld area of a Reed Flash Welded tool joint)—the Wide Open tool joints specifically for light weight drill pipe—the Inarclad hard facing process—the first field proved tool joints for aluminum drill pipe—Reed can weld to any high tensile pipe the mills release for drilling ■

Reed has contributed more to the design of the modern drill string than any other company ■ Reed research, experimentation and development will stay ahead and continue to provide the tools required for advanced drilling techniques ■

The place to look for progress in drilling tools is right here at Reed ■

REED DRILLING TOOLS • AIR TOOLS
ELECTRONICS • TUNGSTEN CARBIDE
PRODUCTS • TREE TRANSPLANTING
EQUIPMENT

Reed Roller Bit Company, Houston 1, Texas • Export Office Time and Life Bldg., Suite 3744 Rockefeller Center, New York 20, N. Y.

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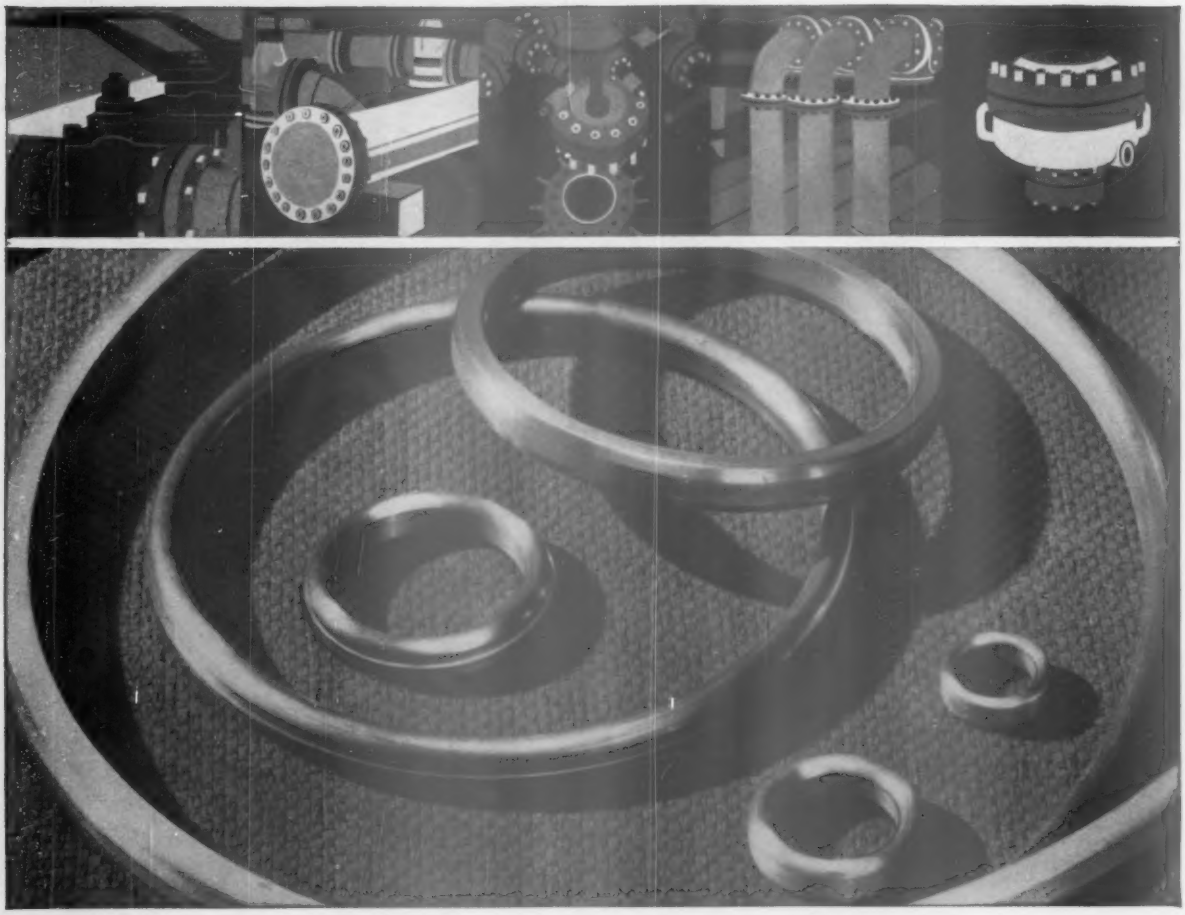
MILWHITE MUD SALES COMPANY
HOUSTON, TEXAS
DIVISION OF MISSISSIPPI RIVER FUEL CORPORATION



Get safer, surer sealing in ring-grooved joints with J-M V-TITE® GASKETS

YOU WILL BENEFIT BY CHOOSING THE GASKET PROVED IN SO MANY APPLICATIONS!

If you are concerned with the design or maintenance of ring-type joints, it will pay you to insist on the tighter, more efficient and longer-lasting seal you get with J-M's V-Tite design. Many equipment builders install these outstanding gaskets, and if it's your job to keep this equipment operating at top efficiency, here's a good point to remember: the gaskets that are right to *start* with . . . are right to *stay* with.

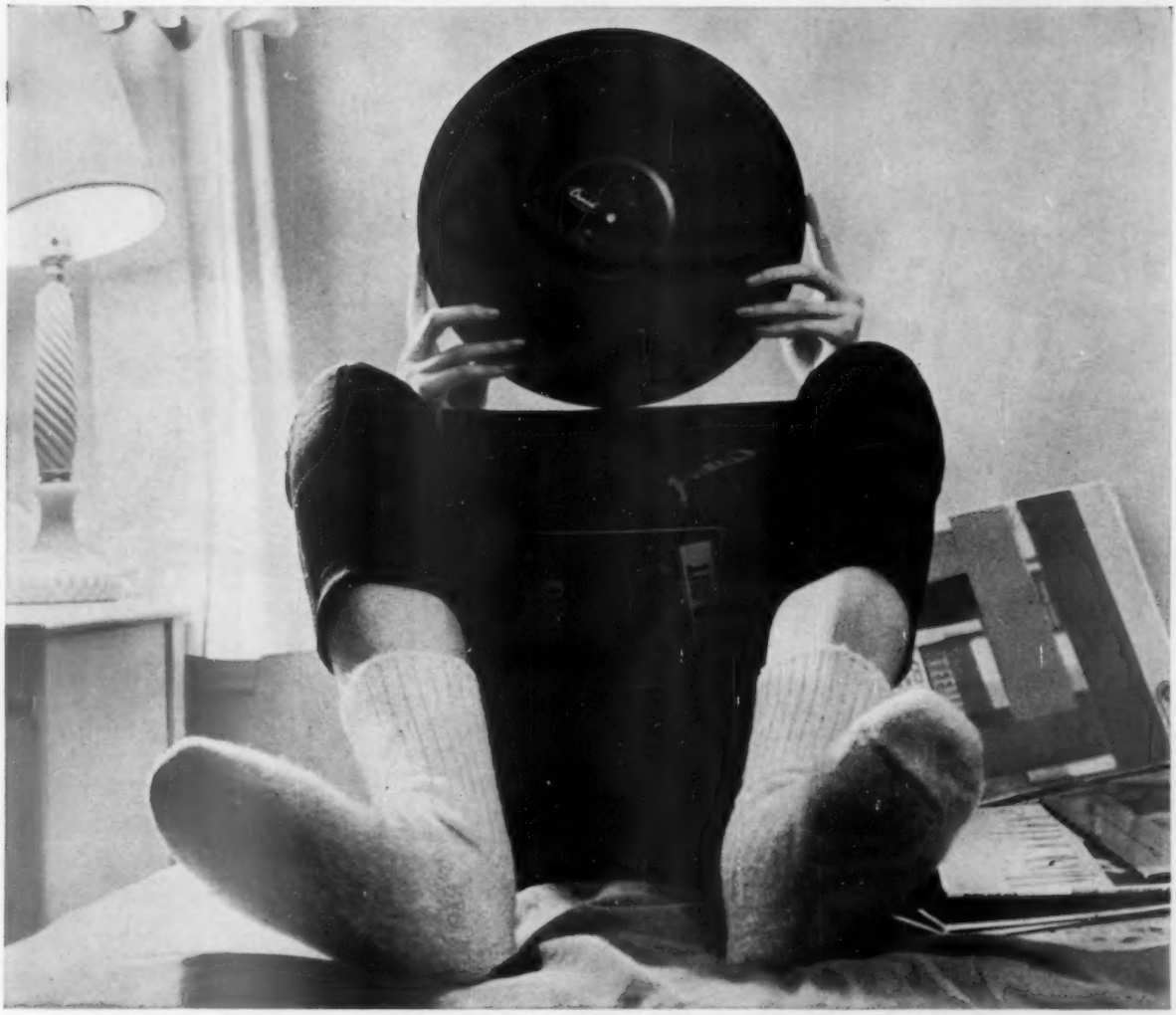
V-Tite Gaskets are "right" because every step in their manufacture is meticulously performed. Close tolerances are rigidly maintained for matching of rings with flange grooves. Carefully-controlled annealing keeps gasket hardness well below flange hardness . . . to assure proper flow and sealing without damaging the flange surfaces. Contact surfaces are smoothly finished . . . with no ridges, no tool or chatter marks that cause joint leakage.

J-M produces a wide selection of custom-designed and standard gaskets in any material, dimension or cross-section you require . . . including the new pressure-actuated BX Ring Gasket for extreme pressure service up to 15,000 psi at temperatures up to 250 F.

Complete information from your J-M Distributor. Or write to Johns-Manville, Box 359, New York 16, N.Y. In Canada: Port Credit, Ontario.

JOHNS-MANVILLE

V-Tite Gaskets meet API specifications



THE
NEW
AMERICAN

TEEN-AGE TEMPO!

They play records at ear-splitting volume. Tie up the telephone for hours. Today's teen-agers are spirited, inquisitive, wonderful.

And nobody knows better than you—the new American with teen-age sons and daughters—that their lives revolve around the car.

Mothers and fathers keep a careful eye on their teen-agers' driving habits. And they know how important it is to keep their car running right.

At American Oil, we take extra care to make petroleum products and provide services that help cars perform the way they should.

As just one example of the lengths we go to, our scientists are studying gasoline combustion with a special furnace that burns fuel the way your engine does. They're gaining new knowledge about what they call "the chemistry of knock" to produce fuels that will perform more efficiently in your car.

You expect more from American—and you get it!

AMERICAN OIL COMPANY

AMERICAN

FULL SPEED AHEAD WITH THE BENDIX G-20 COMPUTER SYSTEM

The old nautical term has a new computing significance, thanks to the over-all system speed of the BENDIX G-20, Here is a modern, solid-state computing system whose high speed is not limited by input/output operations.

Blending high computational speeds with high input-output and transfer rates, the G-20 eliminates data handling bottlenecks... allows through-put (the full input-compute-output cycle) to occur at the maximum speeds of all system components. Magnetic tape transfer occurs, for instance, at 120,000 8-bit characters per second—search is performed at twice that speed. Double transition recording, high packing density, and the elimination of tape skew errors with a unique deskewing buffer provide unmatched tape system speed and reliability.

Helping the magnetic tape units assure input/output to match main frame speed is the BENDIX Data Communicator, allowing simultaneous transfer of data over as many as four channels at 120,000 characters per second each. This simultaneous capability—plus the rapid tape transfer rate—cuts conventional sorting and file maintenance times in half... provides an effective transfer rate of 480,000 characters per second.

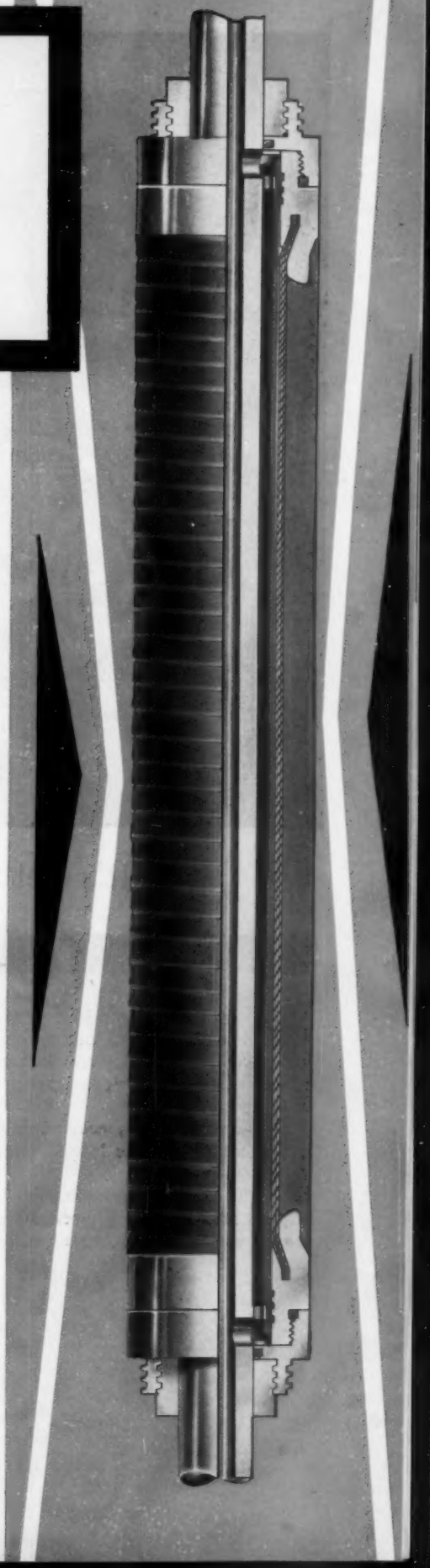
That's why, with the Bendix G-20, your scientific, engineering, or business data processing can move "full speed ahead." Investigate the capabilities of the proven G-20 computer. Write for Bulletin BSP-05611.

Bendix Computer Division
DEPT. AK-36, LOS ANGELES 45, CALIFORNIA

THE Bendix CORPORATION

LYNES

INFLATABLE SEALING ELEMENT



A Basic Tool for Modern Oil Recovery

Sealing in open hole or in pipe with an inflatable element is a simple principle, yet the LYNES Inflatable Sealing Element and packer took ten years of extensive engineering development and testing before this principle became an effective tool for the oil industry.

Since 1950 LYNES Inflatable Sealing Elements have been tried and proven in thousands of wells and are recognized throughout the industry as The Inflatable Packer.

The LYNES Wildcat Straddle Tester using the inflatable sealing element has opened many fields to oil production that would otherwise have been lost by providing a low-cost method for treating and testing questionable open hole zones without setting casing. By the same token, money has been saved by proving holes dry without expensive completion costs.

The LYNES Production-Injection Packer featuring the inflatable element was made available to the oil industry as a sale tool in 1958 and has been proven as a safe and economical solution to many production or injection problems.

LYNES single and straddle element tools are used for treating and testing multiple zones in casing and/or open hole, for making formation fracture impressions, for locating thief zones or casing leaks and for many other uses. In addition LYNES inflatable elements are used on the LYNES INFLATA-TEST Units providing a safe, positive pressure test of tubing after it has been made up to lower into the well.

See how LYNES can help you in your drilling and production operations, call your LYNES representative soon.

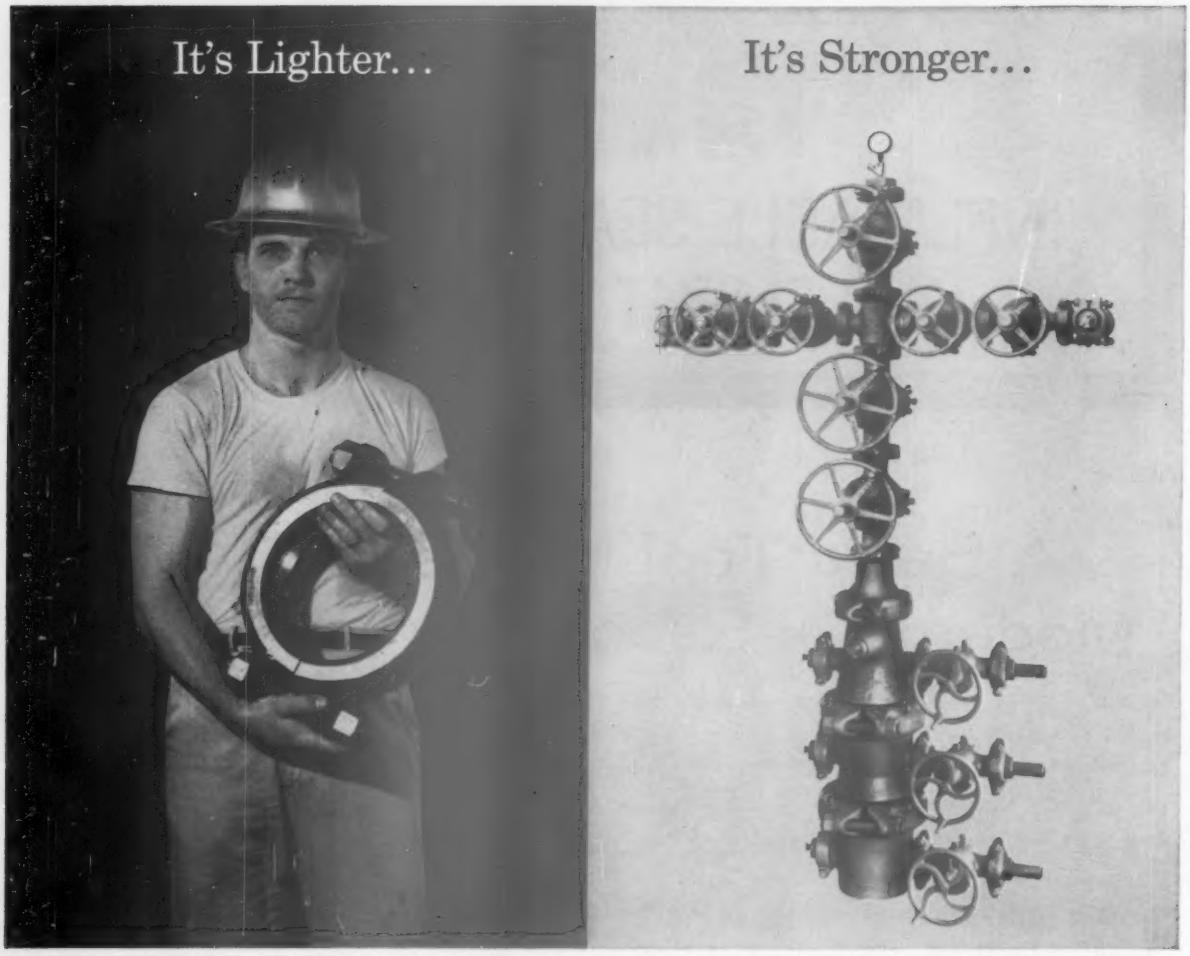
LYNES, INC.

7042 LONG DRIVE • HOUSTON, TEXAS

LYNES

BRIGHT NAME IN THE OIL PATCH

Inflatable Sealing Element Packers



It's Better BECAUSE OF GRAYLOC

A Gray Well Head assembly, with GRAYLOC® connections, weighs about 26% less than a comparable flanged hook-up, yet it withstands an equal pressure. With only two bolts per connection, it's easier and quicker to nipple-up than flanged units and the assembled unit is about ⅓ smaller.

You save labor, space and time while getting the utmost blow-out protection and the longest possible stretch for your production dollar.

Why not let Gray assemblies help you bring your cost down? A great many of our customers have. Just ask your Gray representative or write today for more details.

	Flanged Assembly	GRAYLOC Assembly
Test Pressure	15,000	15,000
Height	136"	111"
Center to center of Flow Wings	95"	86"
Weight	6,591#	4,878#

GRAY Tool Company

6102 P. O. BOX 2291 HOUSTON 1, TEXAS RIVERSIDE 7-1240

"USS Tiger Brand gives us the best service of any rope we ever tried,"

—says John Kirby, Drilling Superintendent.

Dillard & Waltermire, Drilling Contractors of Wichita Falls, Texas, own 14 rigs. They've tried many makes of wire rope and have used USS Tiger Brand for about 9 years. Mr. John Kirby, Drilling Superintendent says, "Tiger Brand has given us the best service of any rope. That's why we keep on using it."

Rig No. 9 was drilling in Hemphill County, Texas. It was equipped with a 2,500-foot length of Tiger Brand 1¼", 6 x 19 Monitor Excellay Rope with wire core. They had already drilled to 11,953 feet and were going to 14,000 feet.

The driller, R. B. Proctor, added this comment, "One thing we like is the help we get from the Tiger Brand Field Service Representative, Jack Morrison. He helped us establish the cut-off practice on this rig and checks the sheaves and drum for wear. Morrison recommended a longer ton-mile run on this rig because wear was not severe."

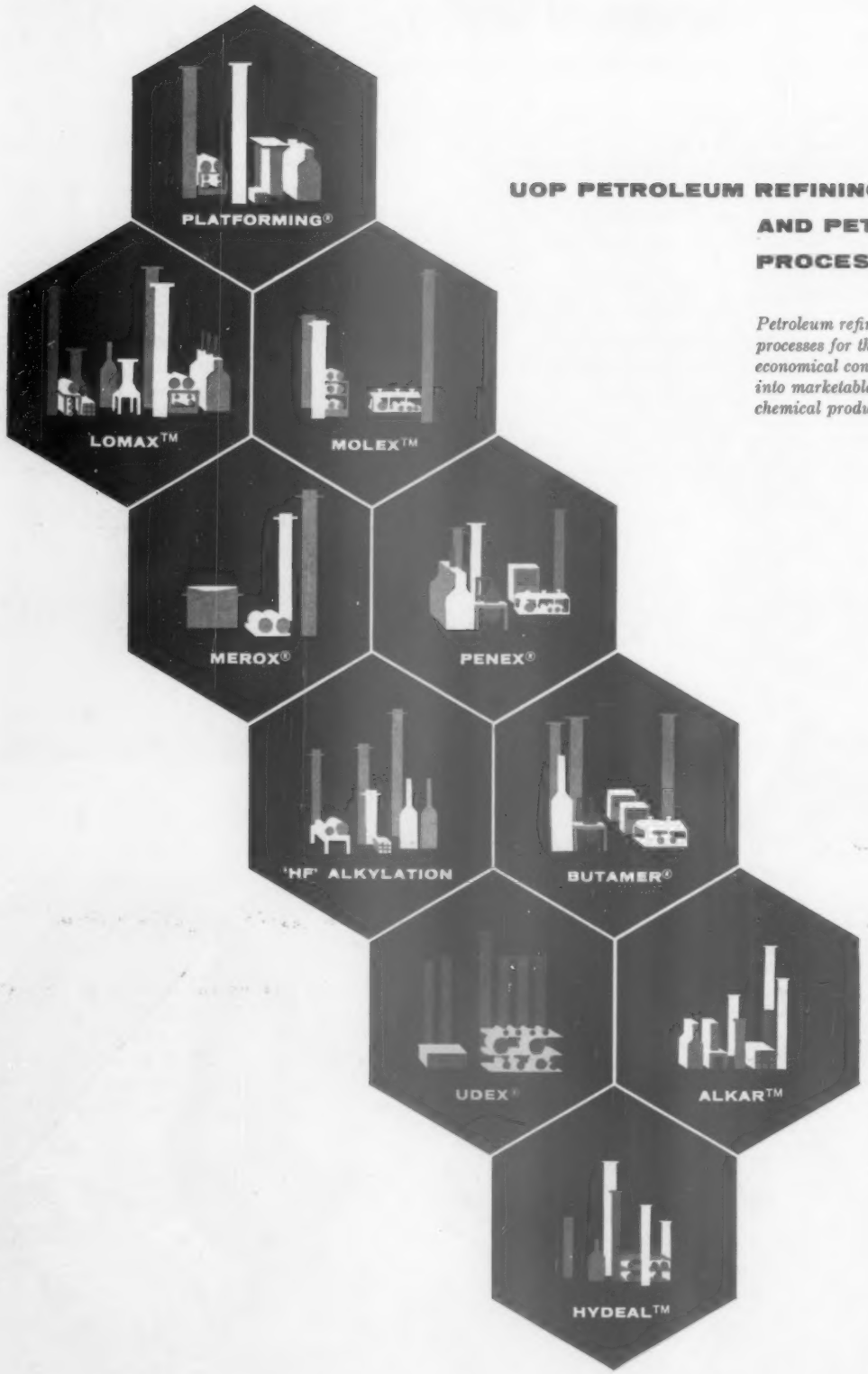
Tiger on the spot. Quick field service from experienced men is an important *extra* you get at *no cost* when you use USS Tiger Brand Wire Rope. Our men cover every field and frequently suggest changes in practice that save you real money.

See the Tiger Brand Distributor. He handles a complete line of sizes and types of oilfield rope and can supply your needs quickly. For additional information, write American Steel and Wire, Room 1436, Rockefeller Building, Cleveland 13, Ohio. *USS and Tiger Brand are registered trademarks*

American Steel and Wire Division of United States Steel

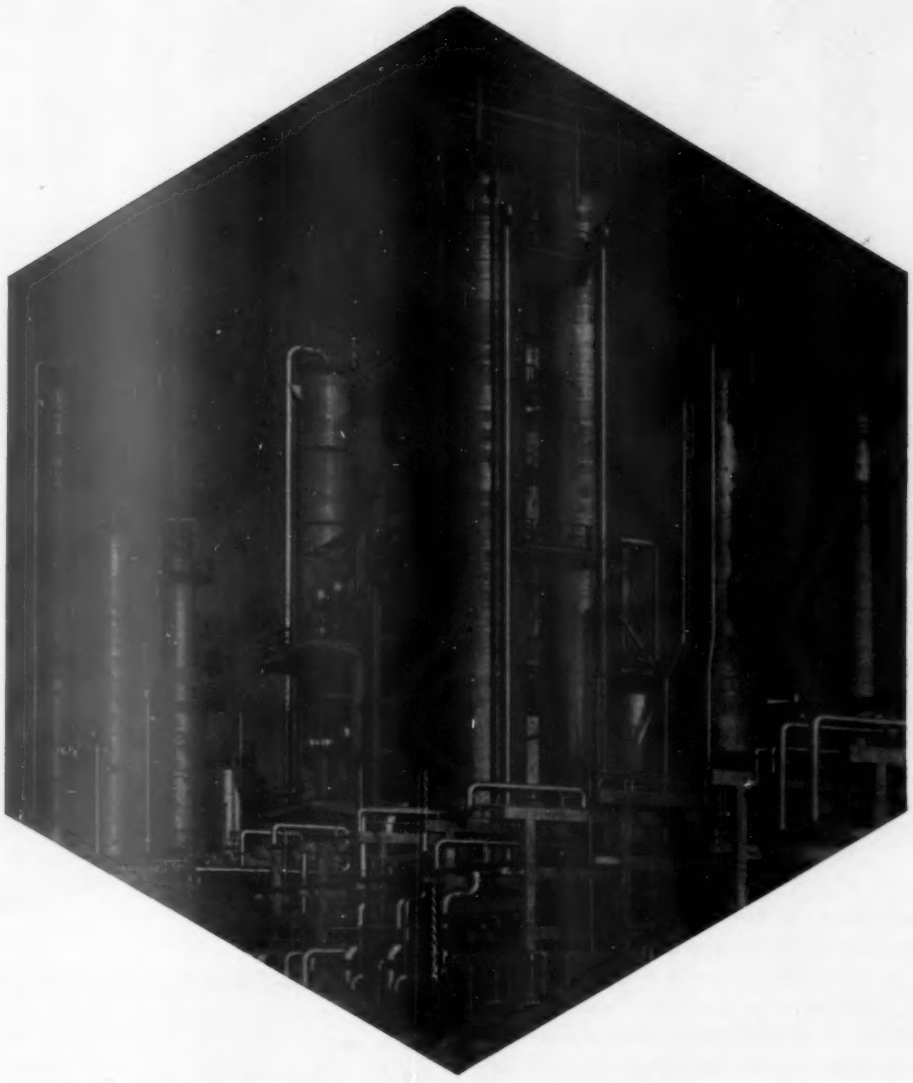
Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, Distributors Abroad

John Kirby, Drilling Superintendent (right) and Jack Morrison, Tiger Brand Field Service man using Tiger Brand ton-mile calculator to figure total ton miles.



UOP PETROLEUM REFINING AND PETROCHEMICAL PROCESSES

Petroleum refining and petrochemical processes for the efficient and economical conversion of petroleum into marketable fuel and chemical products.



produce petrochemicals profitably with UDEX

UDEX® is being widely used by refiners throughout the world for profitable production of high purity petrochemical intermediates, benzene, toluene and xylenes. Udex aromatics meet the highest standards of purity. In addition, Udex is a valuable process for separating high and low-octane gasoline fractions to control the quality of finished gasolines.

Udex provides ideal market flexibility by enabling refiners to make products that meet changing product demands. Low utility consumption and low solvent costs make Udex unusually economical to operate.

Udex has operational flexibilities too. Feed to a Udex unit can vary widely in both quantity and composition, yet the stringent specifications of the product output will be maintained. Originated by Dow Chemical Company, the Udex extraction process was developed and is made commercially available by UOP.

UOP offers a wide range of petroleum and petrochemical processes to refiners everywhere in the free world. A variety of technical services are also available to insure the profitable performance of these processes. Let UOP engineers evaluate your processing needs now.

WHERE RESEARCH TODAY
MEANS PROGRESS TOMORROW

UOP

UNIVERSAL OIL PRODUCTS COMPANY
30 Algonquin Road, Des Plaines, Illinois, U. S. A.

STRAIGHT TALK

ABOUT SIDE ENTERING MIXERS...

There's only one reason for buying side entering mixers: to blend low viscosity liquids in large tanks . . . and keep them blended. A side entering mixer is a simple piece of equipment . . . yet it must be dependable, and properly designed for the job to be done. Put together a propeller, shaft, and mixer drive assembly *specifically designed for the application*—and an electric motor of adequate horsepower—and you have it.

We make these mixers, and we'll tell you—there's no hocus-pocus in this kind of mixing. Results depend solely upon the amount of torque applied by a standard marine propeller.

Economy and long life? These result only from careful manufacture and precise matching of *all* components. We don't merely adapt parts designed for other purposes —we are the *only* major mixer manufacturer to design and build *every* part of a side entering mixer for the specific job it must do.

Install It—Then Forget It. A Philadelphia Side Entering Mixer is as trouble-free as an agitator can get—simple, sturdy, dependable. Take the shaft seal: it's dependable, durable, secure—and you can replace it in minutes. For reliable month-after-month, year-after-year operation, specify Philadelphia.

AVAILABLE IN ONLY ONE DESIGN—
THE BEST THERE IS

- Designed for Motors from 1 to 50 HP
- Precision-Hobbed Gears
- Positive Shut-Off Collar
- Highest Gear Ratings
- Durable, Dependable Shaft Seals

Ask Philadelphia engineers about mixers *and* mixing . . . request 12-page Bulletin PSE-60 on your letterhead today.

PHILADELPHIA MIXER

DIVISION OF PHILADELPHIA GEAR CORPORATION
King of Prussia (Suburban Philadelphia), Pennsylvania

ASK ANY ENGINEER / GEARS ARE THE HEART OF A MIXER

AGMA MEMBER

this Dowell tool has revolutionized well completion, stimulation and workover practices

Seldom in the history of the oil industry has there been a tool as versatile as the one used in Abrasijet*.

By directing high-velocity streams of abrasive in liquid against casing or hole wall, Abrasijet can perform many jobs not previously considered practical. First and most important, Abrasijet can be used to cut slots in casing and formation at low cost. By moving the tool during jetting, either vertical or horizontal slots may be cut to reduce breakdown pressures and to initiate fractures in the direction and plane desired. This use of Abrasijet has resulted in excellent gas/oil and water/oil ratios as well as outstanding production increases.

Second, Abrasijet has been successful in perforating wells that could not be perforated using explosives. Several thicknesses of pipe and cement can be penetrated simply by adjusting the jetting time.

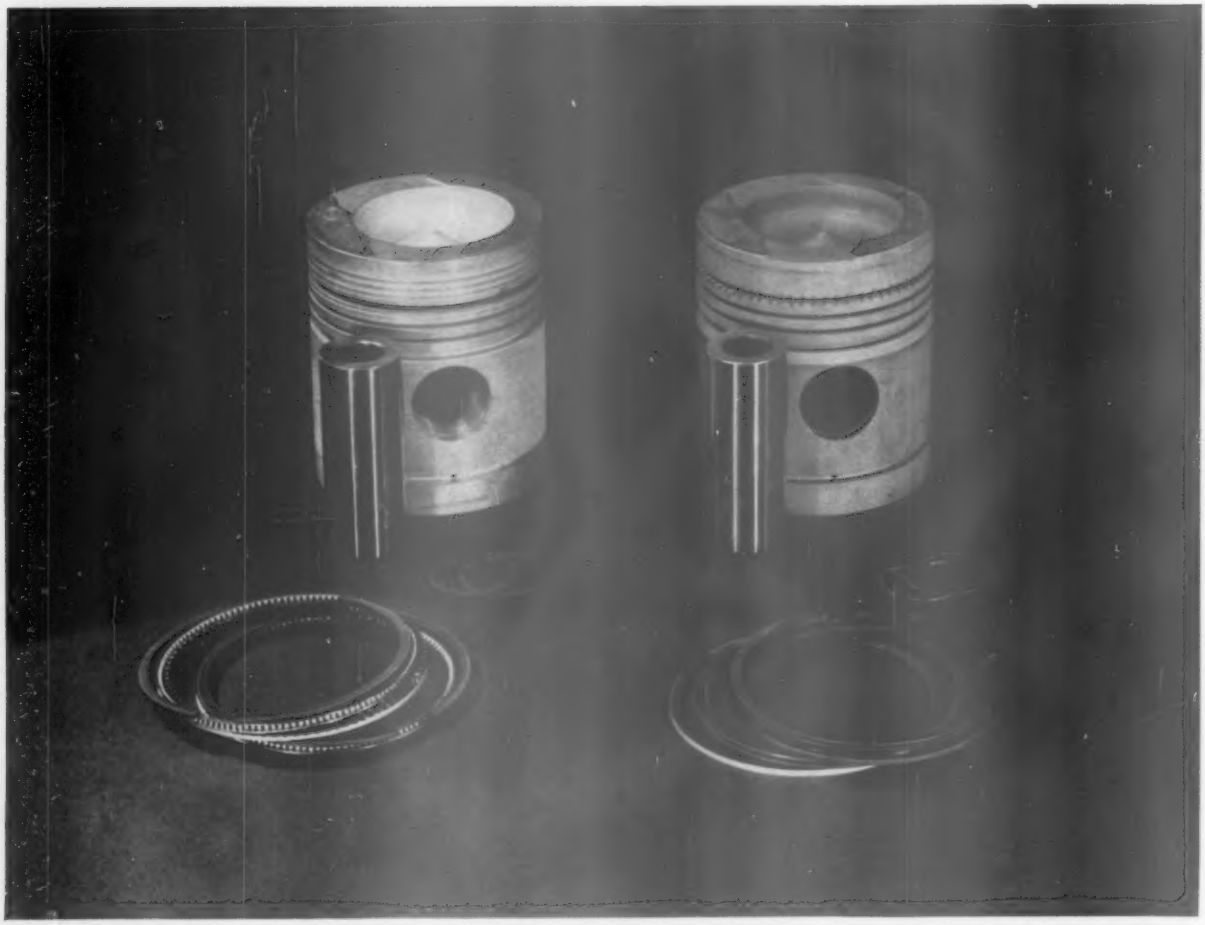
Third, Abrasijet can be used in old wells completed in open hole to clean formation faces that have become plugged with various soluble and insoluble deposits. Since Abrasijet is mechanical in action, a detailed chemical analysis of the plugging deposit is not required.

Finally, there is a special money-saving application of Abrasijet. A tool with downward-pointing jets can use acid without sand to dissolve set cement in casing or tubing. In many cases this is safer and less costly than drilling out.

For detailed information on this versatile service—call Dowell. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma. *DOWELL SERVICE MARK

SERVICES FOR THE OIL INDUSTRY DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY



Which set is your best assurance against downtime?

Naturally you have no way of knowing from the picture which of these two piston sets is better. Probably you couldn't tell even if you were to handle the actual parts. Only when lab and field tests are run on these parts does the economy of selecting the genuine Mack parts—pictured on the left—become obvious.

For instance, in the "will-fit" piston shown on the right the metal is softer and is not tin plated as in the Mack part. This generally indicates a much shorter life and a longer run-in time. It is also about a pound lighter than the genuine Mack piston, so unless a complete set is installed, engine balance will be appreciably disturbed. Valve pockets in the genuine Mack piston are carefully machined after casting for adequate—but not excessive—clearance. Result, higher efficiency. The Mack piston also has scuff bands, a continuous Ni-Resist insert and serrated skirt, all adding to better performance and longer life.

Moreover, the compression rings of the so-called "just-as-good" set are far below Mack standards. Taper in the cheaper set is far from sufficient for optimum performance. Also the gap is too small which necessitates filing of the ring ends during installation to prevent seizure. With the wrist pin it's the same story. The dimensions are OK when new, but excessive expansion indicates inadequate heat treatment or the use of improper alloys during manufacture.

There are other important quality differences between these parts, but the point is this—unless you can afford the expense of extensive laboratory and field tests, you are far better off specifying genuine Mack parts. Only then can you be sure of preserving the Mack quality you invested in originally. In fact, many times genuine Mack replacement parts will actually improve performance, since Mack is constantly improving its parts—original and replacement alike.

When it comes to service, you should make the same comparisons. Mack-trained mechanics can make a big difference, too. Mack Trucks, Inc., Plainfield, N. J. Mack Trucks of Canada, Ltd., Toronto, Ontario.

MACK FIRST NAME FOR **TRUCKS**

Improve your Engineering I.Q.*

* INCOME QUOTIENT

Buyer-Seller "Alliance" Important To Engineers; Orders Are Born of Confidence

It is oftentimes surprising to the engineer that in the course of his career, if it is to be a rewarding one, he will be required to develop talents of both selling and buying. To put it simply: *either you have sold or you have been sold every time you talk to someone.* If you haven't closed your mind, you will often be sold. If you are competent to do so, you will just as often sell someone else.

Selling and buying processing equipment is a highly developed field, but essentially it consists of buying and selling ideas. As you advance into supervisory, management and executive functions, you will be called on to exhibit greater buyer-seller abilities.

Most buying in industry involves from three to six individuals. Although the purchasing agent will be a key factor in all purchasing, almost all purchases in technical fields require the technical assistance of someone outside the purchasing department.

An industrial buyer, whether he is a purchasing agent or an engineer, is *human*, and is responsive to the same human values that you are when you buy a car or a suit of clothes. The industrial purchaser, though, is keenly aware of the plant and organization for which he buys. He is conversant with the product needed, and with its ultimate use.

The purchaser's objective is to procure the right equipment or material, of the right quality, in the right quantity, at the right time, from the right source, and at the right price. In accomplishing this he actually becomes a "salesman-selling-a-salesman."

In modern business the purchasing department should be a profit-making department. A four per cent savings in purchase costs, for instance, might be equal in profits to a 20 per cent increase in sales volume. Considering that the average industrial firm spends about 50 to 60 cents of each sales dollar for purchases, purchasing savings can easily represent the margin of profit.

In one large steel company, costs of products and services bought exceeds four million dollars for each working day. The variety of products bought is in the tens of thousands and these are purchased from nearly 50,000 suppliers.

WRITE FOR YOUR COPY TODAY

BOOKLET E-10
I.Q.*
BUYER-SELLER "ALLIANCE":
IMPORTANT TO ENGINEERS
One of a Series, published by WESTERN SUPPLY CO. Heat Exchanger Division, TULSA, OKLAHOMA

The foregoing paragraphs are taken from one of Western's "professional development" booklets, and reflect our own philosophy on the subject.

Understanding both sides of the coin — the problems of the buyer as well as the responsibilities of the seller —has long been required of all Western sales and engineering personnel. It has contributed greatly to the compatible relationships Western enjoys throughout the petroleum and chemical industries.

Your invitation to discuss heat exchanger problems with your purchasing and engineering departments would be welcome . . . as will your request for your copy of "Buyer-Seller 'Alliance' Important to Engineers."

WESTERN
HEAT EXCHANGERS
WESTERN SUPPLY COMPANY
P.O. Box 1888 – Tulsa, Oklahoma

First joint of Pittsburgh Steel casing is ready to enter hole drilled near the 1907 scene pictured below.

THE ROUGHNECKS WORE DERBIES

Roughnecks casually pour nitro into well preparatory to shooting in the early Bradford field in Pennsylvania about 1907.

Pioneer Independent Distributor Now Sells Pittsburgh Steel Oil Country Goods From New York To Texas

Roughnecks wore derbies and horsepower had tails when one service-minded Pittsburgh Steel Co. independent distributor began operations in the pioneer Pennsylvania grade field.

Today, 54 years later, his flexibility, imagination and personal service still make the difference.

This typical "Mr. Independent" now provides oilmen in eight states with seamless tubular products

Roughneck cleans threads on Pittsburgh Steel seamless casing before running it into hole. Independent distributor who sold this casing has handled Pittsburgh Steel's tubular goods for nearly a quarter-century.

Inspecting joint ends are Peter E. Douylliez, Pittsburgh Steel Co. field engineer; Homer Ferringer, foreman for Manufacturers Light & Heat Co.; and Mark Wagner, salesman for distributor.

made by Pittsburgh Steel Co., a pioneer in its own right, whose experience with oil country goods goes back to almost the turn of the century.

• **From Soft Hats To Hard Hats**—As an early distributor whose history started in 1907, this Mr. Independent grew and flourished with the expanding industry and his stores followed the new fields across two-thirds of the continent.

Now he supplies oilmen in Texas, Oklahoma, Michigan, Pennsylvania, New York, Indiana, Kentucky and Illinois.

Three generations of the same family have run the business with the grandson of the founder now in the president's office.

With service and good products as a foundation, this distributor built up a wide range of shop facilities and repair equipment until now he is unique in the field. Nearly a quarter-century ago, he began supplying his customers with seamless tubular products made by Pittsburgh Steel Co., also a pioneer in its field. Let Mr. Independent tell you himself why these two veterans—an independent distributor and a mill that sells only through non-captive outlets—work together so well.

• **Lots Of Help**—"We get awfully rough competition from some of the big fellows. But we make out by being flexible, imaginative and by giving personal service.

"Pittsburgh Steel gives us a lot of help. The mill bends over backward to cut red tape and it moves fast when it's necessary to get some quick action."

You can't do better than making a connection with an independent Pittsburgh Steel distributor. His only obligation is to his customers.

For your next order of drill pipe, casing or oil well tubing, get in touch with one of the Pittsburgh Steel independent distributors listed below.

Distributor Home Offices

Atlas Bradford Company Houston, Texas	**Iverson Supply Company** Dallas 1, Texas	**Oil Equipment, Ltd.** Calgary, Alberta, Canada
Bennett Supply Company Midland, Texas	**Lion Supply Company, Ltd.** Calgary, Alberta, Canada	**The Producers Supply & Tool Co.** Fort Worth 2, Texas
Buckeye Supply Company Zanesville, Ohio	**Longhorn Supply Co., Inc.** Houston 14, Texas	**Sandy Supply Company** Wooster, Ohio
C. W. Cotton Supply Company Tulsa 5, Oklahoma	**Lucey Export Corporation** New York 7, New York	**Southwest Supply Company** Pittsburgh, Pennsylvania
Dunwoody Pipe & Supply Co. Houston 2, Texas	**Lucey Products Corporation** Tulsa 19, Oklahoma	**Superior Iron Works & Supply Co.** Shreveport, Louisiana
Franklin Supply Company Denver 22, Colorado	**McJunkin Corporation** Charleston 22, West Virginia	**Tex-Tube, Inc.** Houston 7, Texas
Houston Oil Field Material Co. Houston, Texas	**Midland Supply Company** Wichita 7, Kansas	**Triangle Supply Company** Abilene, Texas
Industrial Supply Company Wichita Falls, Texas	**Mountain Iron & Supply Co.** Wichita 2, Kansas	**Western Supply Company** Tulsa 1, Oklahoma

Pittsburgh Steel Company

Grant Building • Pittsburgh 30, Pa.

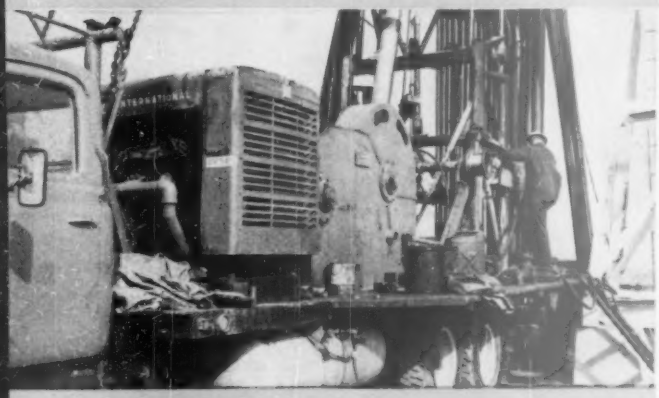
DISTRICT SALES OFFICES

Atlanta	Cleveland	Dayton	Los Angeles	Pittsburgh
Chicago	Dallas	Detroit	New York	Tulsa
		Houston	Philadelphia	Warren, Ohio

Steel

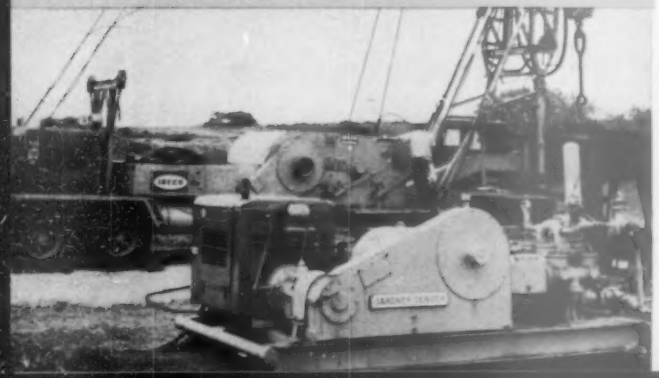
WILSON International's rugged V-8 is sole power for this self-propelled servicing unit. The four-man crew on this rig recently pulled and stacked 6,000 feet of 2⅞-inch drill pipe in one hour!

SKYTOP Fast-moving rig shown below is mounted on an International truck chassis. This unit is pulling pipe from a 5,000-foot well in the High Island area along the Gulf Coast.



COOPER Here's another self-propelled servicing rig completely powered by the dependable UV-549 engine. This unit is working on the coast, replacing pump rods to complete an overhaul.

IDECO This modern rig is typical of today's fast-moving, fast-erecting, fast-working drilling equipment. Typical, too, at most oilfield sites is International power on pumps, compressors and auxiliary equipment.



Drillers choose different rigs, *but the same engine!*

Tough, dependable International UV-549 engine — most popular V-8 in the oilfields. Develops 257 max. hp. One of four International V-8's that burns gasoline, LP gas or natural gas.

It takes a rugged engine to power drilling and well servicing equipment. That's why so many veteran oil men choose heavy-duty Internationals. They know that fast-acting, dependable IH power on drill and draw-works means more profit out of every job.

All oilfield equipment performs more efficiently with a smooth-running, job-matched International engine. Optional adaptations for any of the several oilfield units lets you tailor the power to the job. There are fuel attachments for natural gas and gasoline, and LP gas; engine-mounted air compressor; hydraulic steering pump; Selectomatic torque converter or spring loaded clutch transmission; exhaust condenser; top cylinder oiler; automatic safety shut-off; automatic radiator shutter; magneto ignition and gear-driven mechanical governor.

Call your nearby International Engine Distributor or Dealer for full information on the complete line of 62 Diesel and carbureted models—8 to 385 horsepower.

INTERNATIONAL® ENGINES

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Ill.
A COMPLETE POWER PACKAGE

Contactor No. 8

Gas treating tips from Allied Chemical

Filter Checks from Start-up On Pay Big Dividends in Your Gas Treating Unit

Proper filtration of solutions in an ethanolamine gas treating plant is an operating must from the moment a new unit is started up. Suspended solids are present in greater-than-usual quantities in a new system, and these must be controlled to prevent pump erosion and other damage. This means changing the filter—regardless of type—often enough to insure adequate particle removal.

Getting the Most from Precoat Filters

If you have a precoat filter, you can expect excellent results from diatomaceous earth type precoat materials available under such trade names as Celite or Dicalite. These materials absorb liquid contaminants from the system as well as filter solid particles. Hence they are a big help where liquid constituents are the cause of foaming or other problems.

You should obtain information from manufacturers of these products before introducing them into your system. You may have to go through a trial and error procedure to determine which precoat material is best for your particular amine treating plant.

In addition, it's a good idea for plant operators to learn how to change precoat materials prior to actual operation. Otherwise an inexperienced man may accidentally lose fairly large quantities of amine solution on his first try.

With a precoat material, filter changes are very inexpensive. There is no excuse not to make changes often enough to assure passage of as much solution through the filter as possible. Proper operation demands it—especially during the early life of the unit to remove waste matter remaining despite start-up cleaning. Units processing sour gas will also pick up a heavy iron sulfide load in the filters until the sulfide coating becomes sufficient to protect the equipment.

Precautions with Sock Type or Cotton Waste Filters

It is very hard for sock type or cotton waste filters to do the job required of them in amine treating plants. Consequently, it is absolutely essential to replace filter cartridges when the filter loads up to the point of by-passing a portion of the stream due to pressure drop.

Often, because of the high cost of filter replacements, operators by-pass loaded filters for a rather long period of time. This is poor practice and poor economy unless the plant has been in operation long enough for the operator to be sure that no great amount of sludge will build up.

How Charcoal Filters Fit In

Charcoal filtration gives very satisfactory results when used in combination with another filter such as a sock type. It is not recommended alone for the simple job of filtration since charcoal is quite expensive for a filter material, and deposition of solids makes it unsuitable for regeneration.

In tandem with another filter, the charcoal filter will: 1. Absorb very small particles that pass through the sock type or waste filter. 2. Absorb hydrocarbons and other troublesome components from the amine solution. Thus, where large quantities of contaminants are causing foaming or other troubles, this set-up may be the best solution.

Despite published reports to the contrary, charcoal filtration is not recommended for reclaiming contaminated and degraded amine solution. Allied Chemical experts feel that a side stream reclaimer is more efficient at less cost.

FOR MORE INFORMATION on gas treatment, look for the next GAS TREATING TIPS.

For specs on Allied Chemical Ethanolamines and Ethylene Glycol, and offices, see Chem. Materials Catalog, page 272, and Chem. Week Buyers' Guide, page 272A. 2819

Allied Chemical

NITROGEN DIVISION
Dept. C8-55-1, 40 Rector St., New York 6, N. Y.

Oil company reports PERFORMANCE PLUS with Sumitomo steel tubing

A leading drilling company in Texas reports that Sumitomo tubing far exceeded API specifications when run as drill string, despite 46 rugged round trips in and out of a 5700-ft. well under 1200-lb. mud pressure.

Performance like this shows why Sumitomo steel pipe and tubing, produced in accordance with API, ASTM and many other international standards, are exported in all sizes and grades to every major part of the world.

Available in API Standards in the following sizes:

Casing 4½" to 13⅜" O. D.
Tubing 1.660" to 4½" O. D.
Line Pipe 0.840" to 14.00" O. D.
High Test Line Pipe 6⅝" to 14.00" O. D.

LEADING MANUFACTURER OF STEEL TUBES AND PIPE WIRE RODS AND ROLLING STOCK PARTS

SUMITOMO METAL INDUSTRIES, LTD.

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UNION PIPE, INC.
(AGENT OF OIL COUNTRY TUBULAR GOODS IN U.S.A.)
420 LEXINGTON AVENUE, NEW YORK 17, N.Y.

HAGAN X-2 . . . TRIPLE-DUTY CORROSION INHIBITOR

corrosion controller • biocide • cleaner

Hagan X-2 is a highly polar, film forming corrosion inhibitor particularly effective against hydrogen sulfide and carbon dioxide. X-2 also effectively controls many common micro-organisms, including the sulfate reducing type. As X-2 deposits a thin protective coating on metal surfaces, it removes accumulated corrosion products, cleaning water lines, valves, pumps and meters. Hagan X-2 is miscible with both fresh and salt water and is easy to feed. It may be used in producing wells, in water flood injection, salt water disposal and oil treating systems. Here are a few of the successful Hagan X-2 applications:

1 A North Texas oil producer injecting a mixture of brines had problems. Increasing corrosion and leaks forced him to use a corrosion inhibitor. He soon had trouble with the graded bed filter, and injection pressures began to climb. Study by a water consultant showed the filter media to be heavily coated with corrosion inhibitor and suspended solids. Repeated backwashing was ineffective. After replacing the filter media, the use of Hagan X-2, was begun.

Leak frequency was reduced, the filter media could be backwashed clean by normal procedures, and filter efficiency has been maintained for the past two years. The water at the input wells has remained clean and injection rates have been satisfactory.

2 In southern Oklahoma, a unit water flood operator became concerned when "black water" was noted at the injection wells of his new system. Corrosion rates measured on 30 day test specimens were between 8 to 15 mils per year. Also, large numbers of sulfate-reducing bacteria were entering the system. Corrosion had also been occurring in many producing wells.

A weekly batch feed of 5 gallons of Hagan X-2 corrosion inhibitor-biocide was begun in the most troublesome producing wells. This alleviated the corrosion problem in the wells by cleaning up the produced water.

Later complete bacterial control and 30 day corrosion coupon rates of 0.1 to 0.4 mils per year were obtained by adding Hagan X-2 at the injection plant only three times a week.

3 Many products had been tried over a period of one year to reduce acid gas and sulfate-reducing bacteria corrosion in a water flood project. Filter efficiency was drastically reduced and an inspection of the unit showed the media was fouled with iron sulfide held in a matrix of brine-insoluble corrosion inhibitor. The operator realized that there probably was similar fouling of injection sand face.

A continuous treatment with Hagan X-2 at the produced water storage tank supplemented by a slug treatment at the supply well was initiated. The operator installed wellhead filters with disposable cartridges at each injection well. The cartridges were changed frequently for three or four weeks, then, as the system was purged of deposits and debris, the frequency declined.

Successful bacterial control has now been obtained with Hagan X-2. Filter efficiency has remained high and leak frequency has been nil.

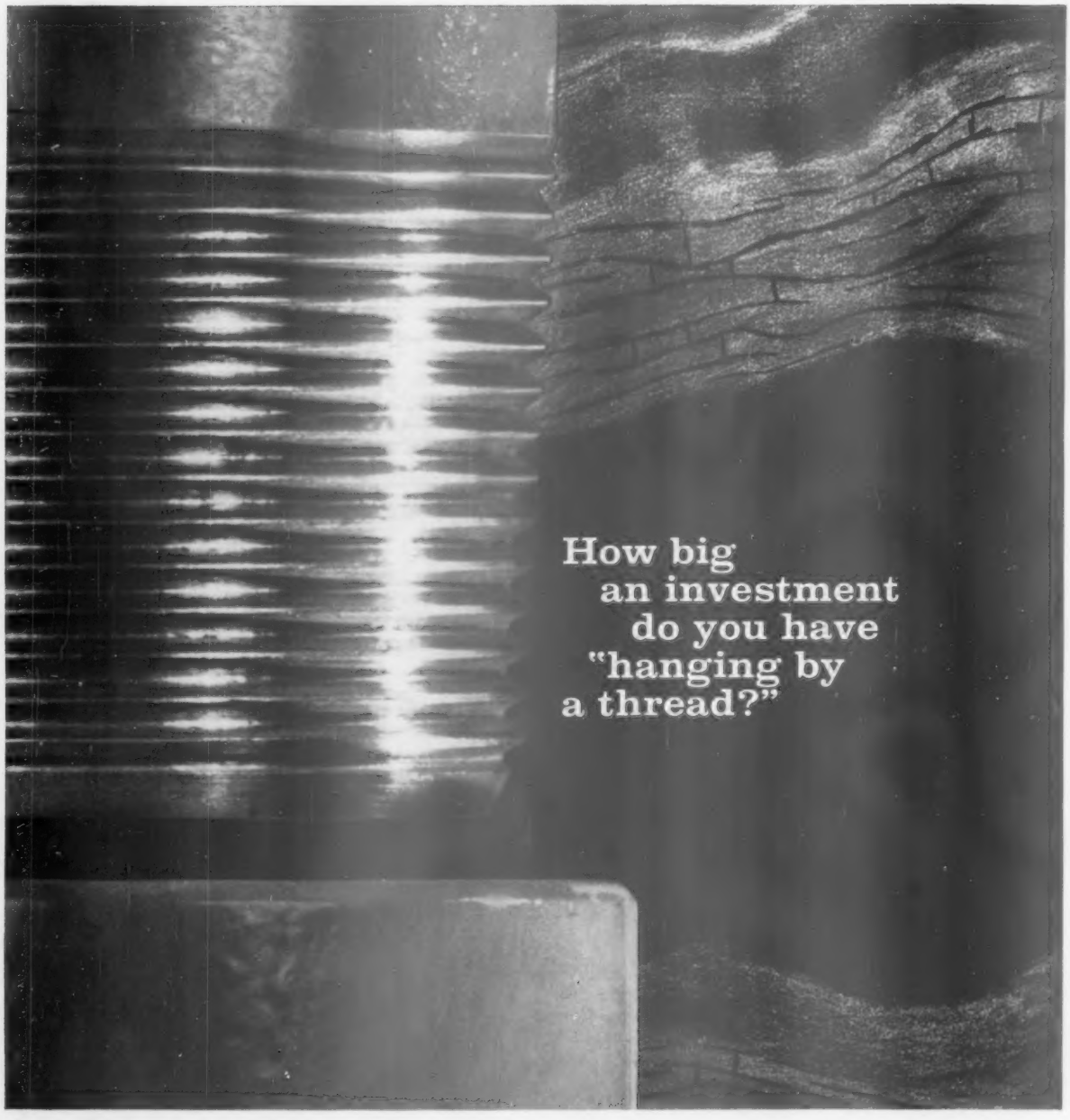
HAGAN—Your only complete source of chemical feeding equipment, water treatment chemicals, field laboratories, engineering service.

HAGAN

CHEMICALS & CONTROLS, INC.

HAGAN CENTER, PITTSBURGH 30, PA.

HAGAN OILFIELD OFFICES: Bradford, Huntington, Evansville, Little Rock, New Orleans, Tulsa, Houston, Abilene, Midland, Denver, Fort Morgan, Casper, Los Angeles. In Canada: Edmonton and Toronto.



The deeper you go for oil the bigger your investment . . . and the deeper you go the more dependent that investment becomes on the threads that link your casing or tubing into an inseparable unit. That's why the threads for CF&I Seamless Casing and Tubing must pass the most exhaustive of tests—including painstaking checking with a contour microscope. The right lead . . . the right taper . . . the right height . . . the right size—these are some of CF&I's requirements that mean extra strength and pressure-tightness.

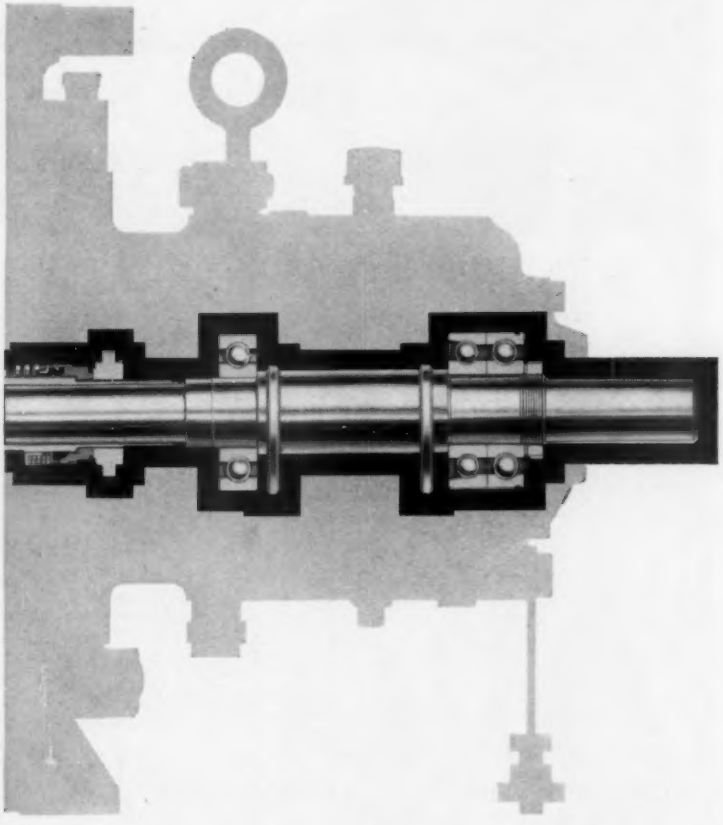
Available in sizes 2⅜" through 9⅝" O.D., CF&I Casing and Tubing meets API STD 5A specifications. Your nearby CF&I sales office or distributor has complete details and can provide prompt delivery. 8494

. . . means strength and economy

The Colorado Fuel and Iron Corporation
Denver • Oakland • New York
Sales Offices in Key Cities

CF&I STEEL MADE IN U.S.A.

WHEN IT'S 750° HERE



...IT'S ONLY 250° HERE

intermediate-range pump HANDLES BIG, HOT JOBS

Now you can pump liquids *as hot as 750°F*—and handle pressures to 600 psi—with a pump that costs little more than a light-duty unit.

Goulds Model 3775 petroleum process pump can save you buying much heavier, costlier pumps for these jobs. It pumps 1200 gpm. And it is the only pump designed around a mechanical seal that gives you *both* high-temperature operation and easy upkeep of back pull-out.

Hot pumpage flowing through this pump never touches the mechanical seal—because the seal is isolated in its chamber and surrounded by cool, dead-ended liquid. Coolant circulates through jacket to hold seal face to 250°, even with pumpage at 750°. External flush or heat exchanger cooling is possible, too.

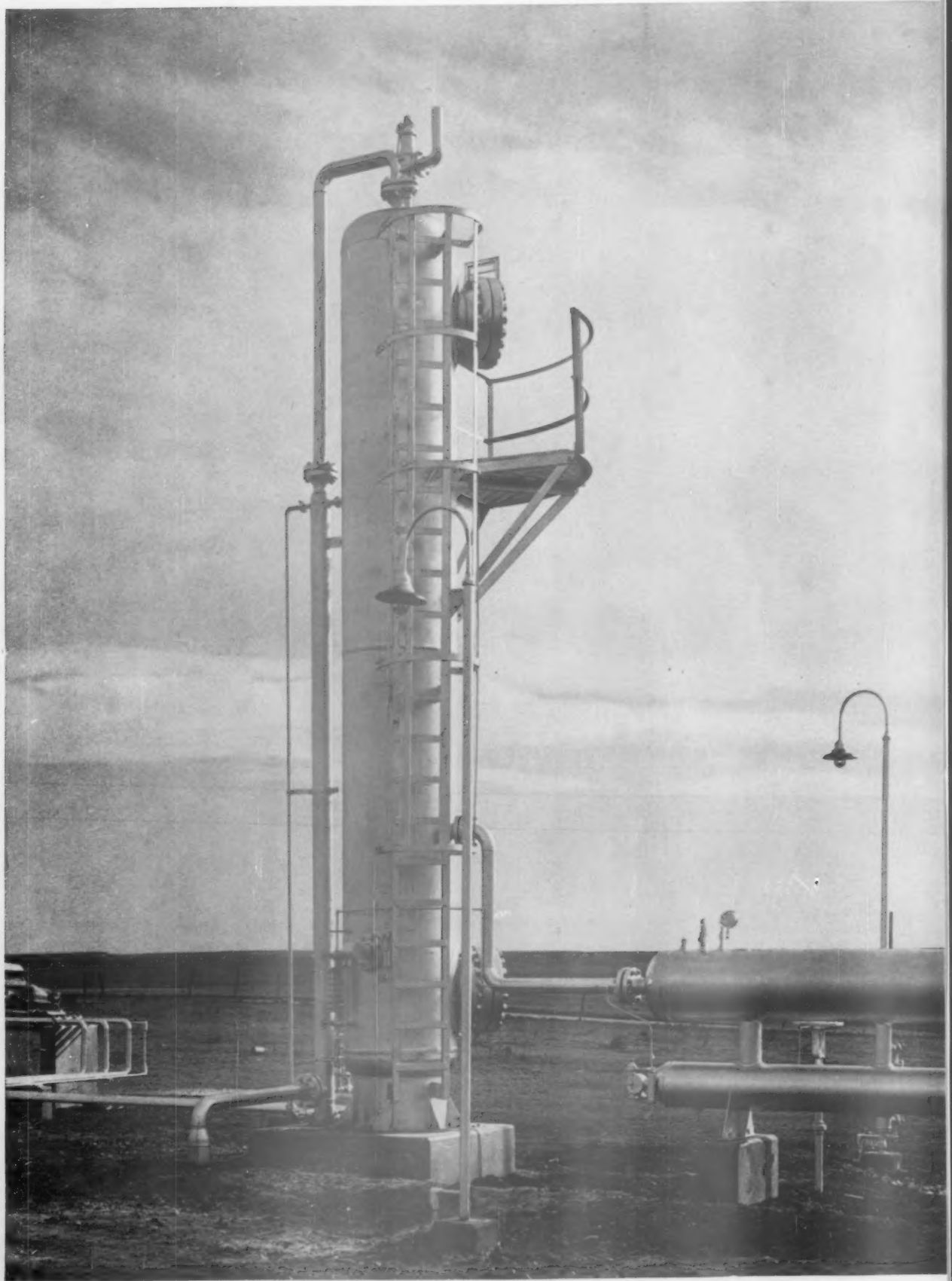
The seal is the *heart* of the pump, not an accessory. Because the pump is designed around the seal, it makes full use of seal advantages. Model 3775 has the lowest overhang ratio of any pump operating above 300°F. Its short shaft helps insure a true-running, long-lived seal.

Mechanically rugged, it is built to API 610 specs; centerline mounted with a vertically split casing. Typical of its quality is the dowel-pin fit alignment of bearing housing and casing cover, which assures perfect alignment and part replaceability.

To see where this cost-cutting pump can fit into your operations, send for our Bulletin 724-1. It gives specifications, construction details, pressure-temperature chart, and other helpful information.

Goulds Pumps Inc., Dept. OGJ-121, Seneca Falls, N. Y.

GOULDS PUMPS



DOW petroleum industry chemicals

GAS PROCESSING

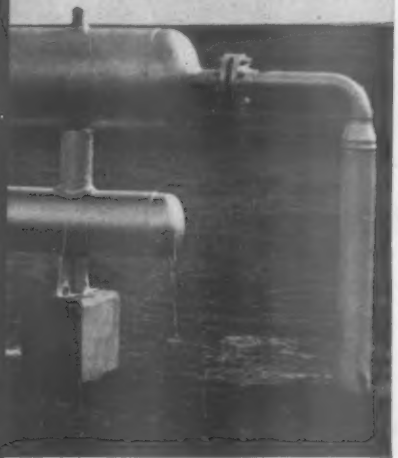
HYDRATE PROBLEMS? CALL ON DOW FOR COMPLETE SERVICE

Whether your problem is a pressure drop caused by hydrate formation or a high dew point, Dow's Gas Conditioning Service can assist you. Dow has accumulated extensive experience in the field of gas conditioning all the way from production and research of the chemicals used, to economical, efficient operating procedures.

Complete technology on glycols in operation of low temperature separation units is readily available. Dow representatives, distributors, and technical personnel from Dow's Gas Conditioning Laboratory are available for consultation.

Fast, efficient delivery of glycols for hydrate inhibition and dehydration, as well as amines for sweetening, is assured by Dow's network of production plants, terminal facilities, and their distributor warehouses.

Dow's active participation in gas processing research continually turns up improvements or cost reductions in processing and laboratory techniques. For assistance in gas conditioning problems, or for complete procedures for setting up your own testing facilities, get in touch with your nearest Dow sales office, Dow distributor, or contact Dow in Midland, Michigan.



For a copy of our latest book, HYDRATE INHIBITION WITH GLYCOLS, write to The Dow Chemical Company, Abbott Road Building, Midland, Michigan, Attention: Chemicals Merchandising.

THE DOW CHEMICAL COMPANY DOW Midland, Michigan

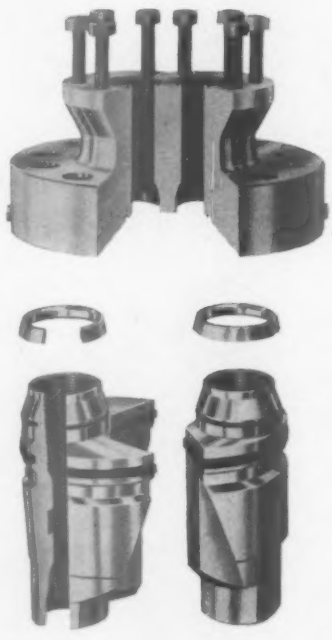
Rector "MCT" Triple Completion Tubing Head

Single, dual or triple . . . Rector's versatile MCT Tubing Head offers multiple tubing hanger arrangements that make it possible to complete a well with one, two or three tubing strings without changing the tubing head or using special attachments. All strings can be run independently without the removal of blow-out preventers. Hangers are automatically aligned in the head by fixed lugs that insure positive accurate seating without the use of guide pins. A special **RECTOR** multi-seal ring on each hanger in dual and triple completions insure positive steel seal for each tubing string. In single completion application, steel seal is obtained by use of an API ring gasket

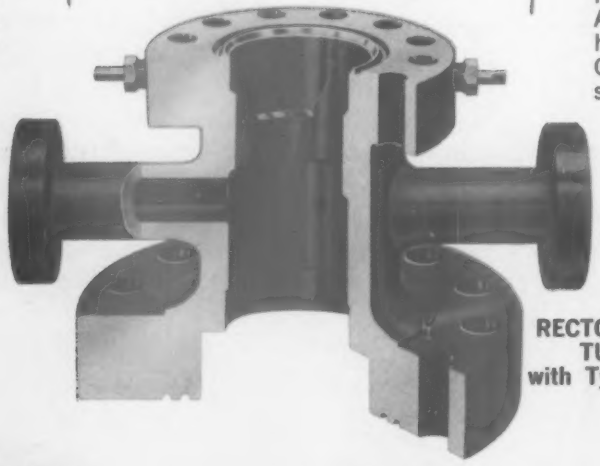
Resilient packing elements on all hangers along with removable **RECTOR-PSI** back pressure valves insure control of well during removal of blow-out preventers and installation of Christmas Tree.

For full information, contact your **RECTOR** representative or your favorite supply store.

Type "LST" Hanger and Adapter Flange
Single Hanger for use in "MCT" Tubing Head. Available with Back Pressure Valve Groove.



Type "TLCT" Hangers and Adapter Flange
Dual Hangers for use in "MCT" Tubing Head. Allows one string to be hung in tension. Grooved for Back Pressure Valve.



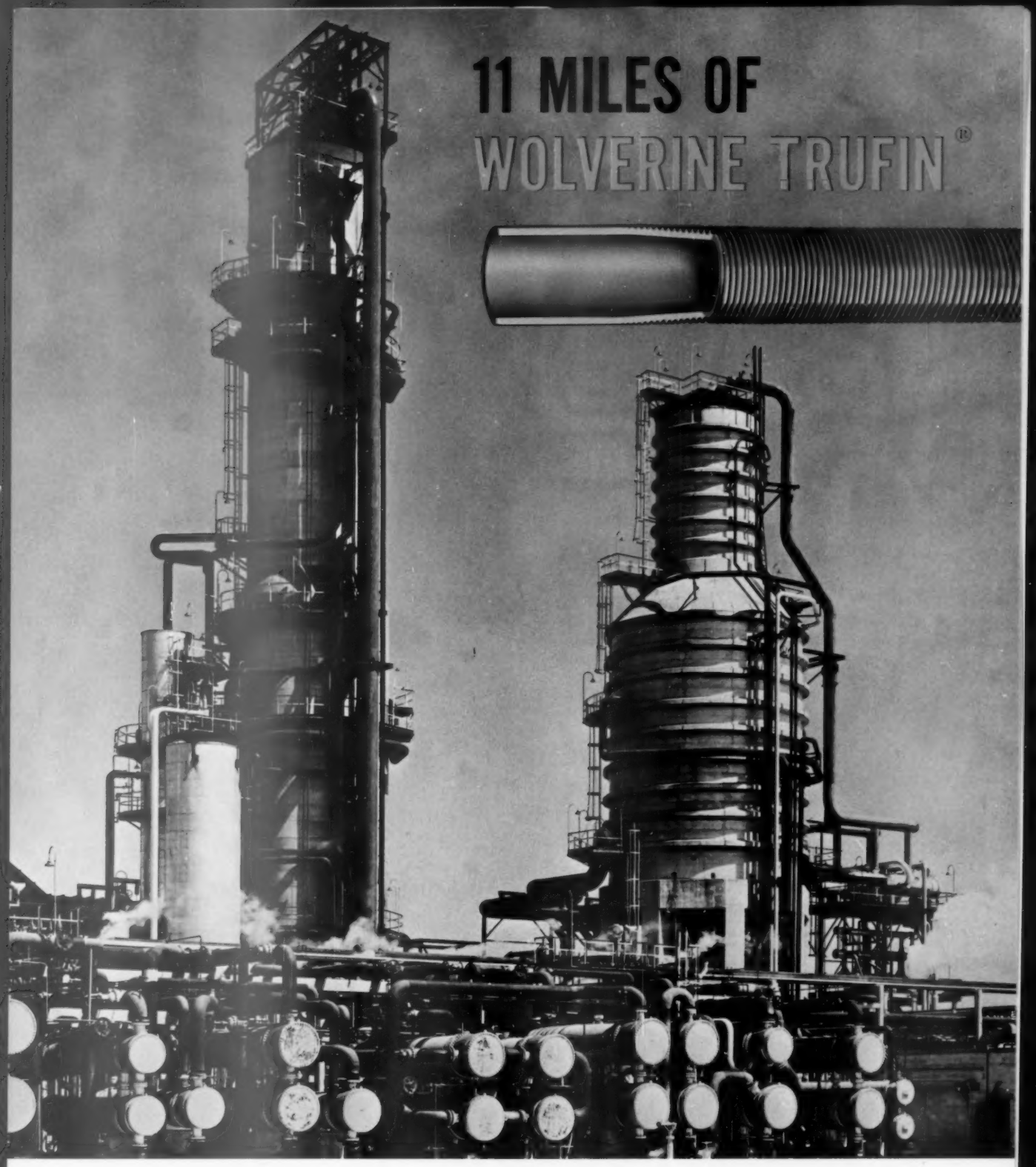
RECTOR TYPE "MCT" TUBING HEAD with Type "LCT" Triple Hangers

MONOGRAMMED EQUIPMENT

PESA

Rector
WELL EQUIPMENT CO., INC.
Making the Oil Industry Safer!

1100 North Commerce, Fort Worth, Texas • Houston Plant: 2215 Commerce Street
EXPORT REPRESENTATIVES: CONTINENTAL-EMSCO CO., MID-CONTINENT SUPPLY CO., OILWELL DIVISION OF UNITED STATES STEEL CORPORATION



More than 11 miles of Trufin Type S/T–the integral finned tube–have been used in nine of the shell and tube heat exchangers which are the heart of the world's largest crude oil pipe still. Located in a midwestern refinery, the still is producing 140,000 barrels per day! More than 95% of the Trufin involved is made from Admiralty Brass.

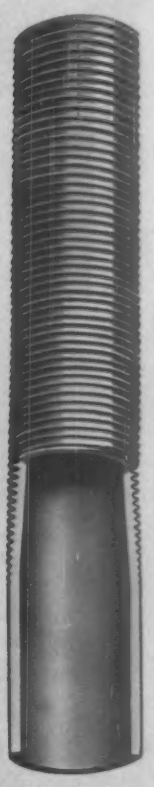
Yes, 11 miles of Trufin is a lot of tube–but just visualize the space savings that Trufin has provided. To perform the same heat duty as Trufin, more than 20 miles of prime surface tube would have had to be used. The advantages are obvious–fewer tubes, fewer shells, much less space required, and more production.

The complete range of finned tube products made by Wolverine Tube is shown on the other side of the page. It's a product line proven by experience.

Write today for more information.

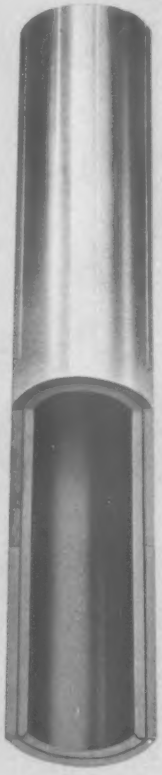
Wolverine Tube manufactures the industry's most complete line of finned tube

PRIME SURFACE TUBE

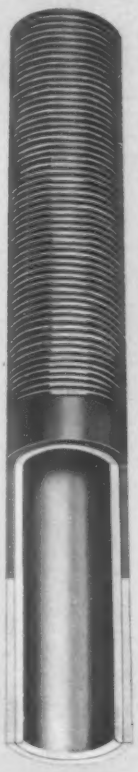


WOLVERINE TRUFIN TYPE S/T

WOLVERINE TRUFIN TYPE W/H



DUPLEX PRIME SURFACE TUBE

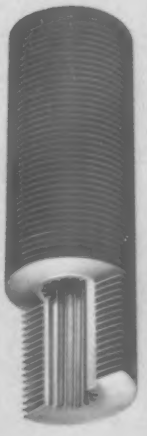


DUPLEX WOLVERINE TRUFIN, TYPE S/T

WOLVERINE TRUFIN TYPE L/C
Bimetal

WOLVERINE TRUFIN TYPE H/R

WOLVERINE TRUFIN TYPE H/A



WOLVERINE TRUFIN TYPE I/L

FINNED AND PRIME SURFACE U-BENDS
arranged in a disposable box-type pallet

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DIVISION OF
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PLANTS IN DETROIT AND INKSTER, MICHIGAN AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

THREDLOK®

The **best** way to lock casing...**can save $40 to $90** per string!

THREDLOK Compound seals casing tighter and stronger than tack welding . . . prevents possibility of heat damage to tempered, high-strength casing. Yet THREDLOK costs *less* than welding!

With THREDLOK, your own crew can lock and seal the lower joints in a casing string for about $10.00. Out-of-pocket costs of welding would be approximately $50 to $100. So THREDLOK can save you $40 to $90 *cash* per string. And the extra protection THREDLOK gives casing threads can save you much more.

Get THREDLOK next time you run casing. Available through Humble Bulk Plants or Humble Oil & Refining Company, Houston, Texas.

HUMBLE OIL & REFINING CO.

America's Leading ENergy COmpany

ENCO PRODUCTS

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ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

WOULD YOU BELIEVE THAT ONE DROP OF OIL COULD BE THIS IMPORTANT?

If a 12 cylinder, 2,000 HP, 330 RPM engine uses **ONE-EIGHTH OF A DROP** of additional oil per stroke in each cylinder, here's what will happen: your oil consumption will increase from 8000 BHP hours per gallon to 2000!

And that's the big reason Cook rings save you money. Like other oil control rings, Cook rings meter oil and properly spread it, but Cook rings do this in addition: *they prevent excessive use of oil!*

Don't just get oil wiper rings . . . get Cook *engineered* conformable oil wiper rings, the most copied oil control rings in the world!

"IMPROVE YOUR PISTON RING PERFORMANCE"

SEND FOR FREE 8-PAGE BOOKLET

Write for your free copy of this technical article. Gives valuable data on improving your engine's performance and keeping it high for longer periods by better cylinder sealing. Offers practical advice on (1) how to tell whether rings should be reused or replaced, (2) choosing a ring setup, (3) relieving top ring load, and other problems. In short, it's a brief, handy guide to better piston ring performance. For your copy, write C. Lee Cook Division, Dover Corp., 934 South 8th Street, Louisville 3, Kentucky.

WRITE FOR COOK'S NEW PISTON RING CATALOG

Sixteen-page catalog just off the press. Describes complete line of piston rings manufactured by C. Lee Cook Division, also the special seals and rings of the Airtomic Division. For your free copy, ask for Bulletin 610, C. Lee Cook Division, Dover Corp., 934 South 8th Street, Louisville 3, Kentucky.

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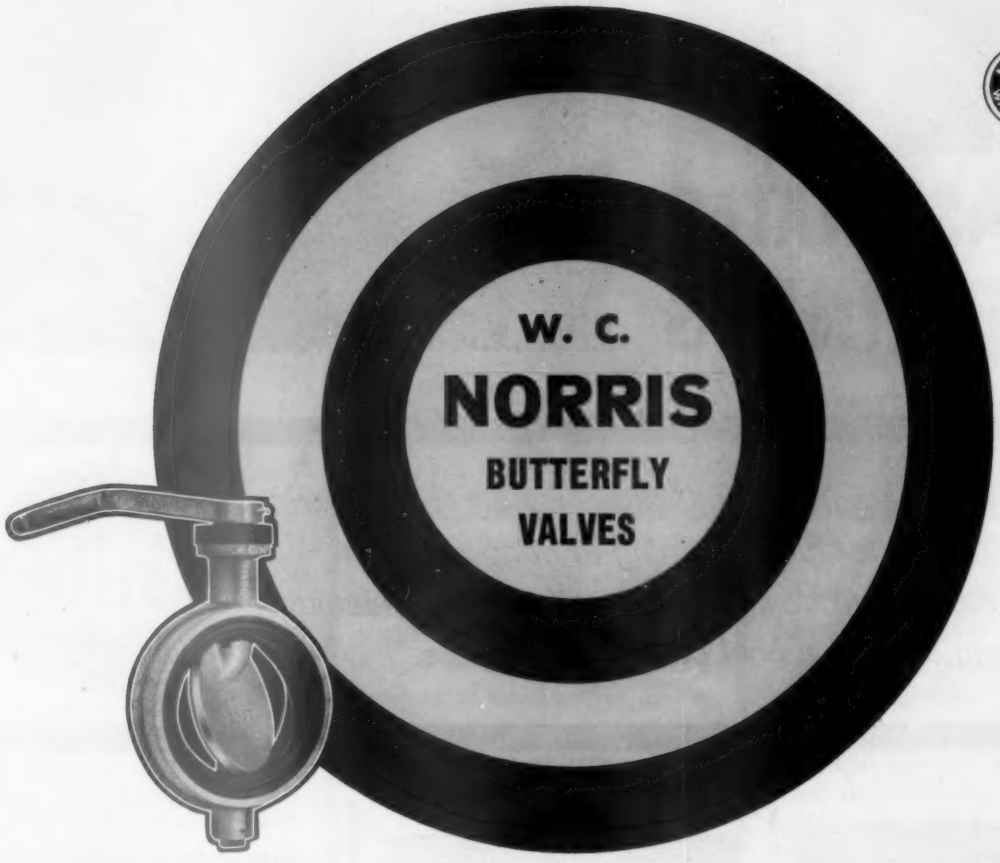
Rings and Packings Since 1888



Target Versatility-Economy

Now you can reduce costs and simplify valve specifying by using the highly versatile and economical Norriseal Wafer Type Butterfly Valve. Designed for working pressures to 150 psi, the Norriseal Valve features removable and interchangeable rubber and metal seats . . . takes up less line space . . . can be easily and quickly removed for "on-the-spot" maintenance . . . is field repairable. The wide selection of trim available qualifies the Norriseal Valve for use in many oil field and industrial applications.

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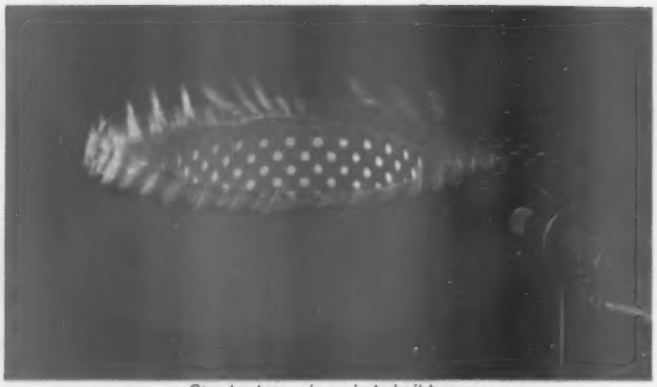
BRANCHES: Great Bend, Houston, Kilgore, Odessa, Wichita Falls, Salem, Casper, Farmington

NEW AIR-ASPIRATED OIL BURNERS



Circular-type, air-aspirated oil burner

These new burners from the Gulf Oil Corporation aspirate and atomize fuel for clean burning at firing rates as low as 0.005 gph. In doing so, they offer new versatility in shape and size for a host of new product uses

GULF

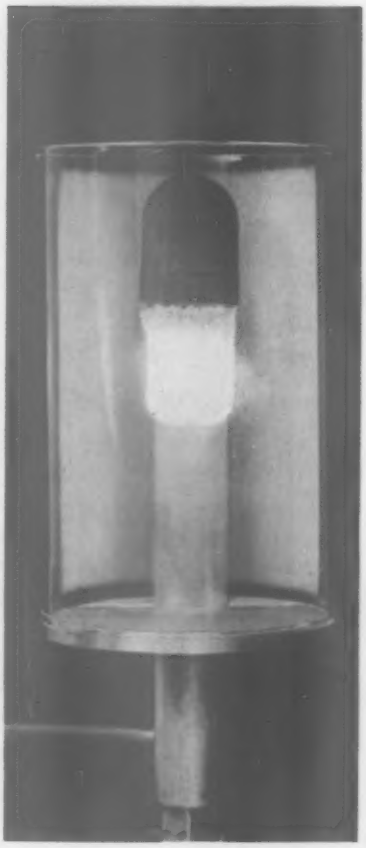
Here is a remarkable, new kind of oil burner so compact and clean-burning it opens a whole new field of product advances and new product applications.

New concept in oil burners. In the quest for improved oil-burning equipment, Gulf scientists at Gulf's Harmarville Research Center developed this air-aspirated oil burner of amazing versatility and capacity.

Inside the nozzle, which operates at only 3 psi pressure, air and oil are thoroughly mixed before combustion. Result: cleaner, more efficient burning — and far less need for servicing.

Minimizes nozzle clogging. The large oil passages in Gulf's new nozzle practically eliminate nozzle clogging. They're up to 12 times larger than the passages in a conventional 100 psi pressure nozzle. The orifice is about 38 times larger!

A .005 gph nozzle—for illumination!



Still greater efficiency is achieved because there is no dribbling of fuel, either at start or shut-down. The nozzle temperature remains relatively low because it is cooled by air blown through it. This reduces the possibility of oil deterioration resulting from high nozzle temperature. In addition, there is no need for a combustion chamber!

Extraordinary nozzle capacities. Today's gun-type burners have usually been limited to about 0.65 gph for high-pressure burners, about 0.4 gph for low-pressure types. Below these, capacity nozzle clogging becomes particularly acute.

Gulf's new aspirating nozzle, on the other hand, offers you capacities undreamed of just a few years ago.

In the size used to power an ordinary illuminating mantle, for example, it fires at only .005 gph!

This is an unusual application, of course. But it does indicate how small a firing rate you can use with the new Gulf nozzle.

More usual capacities are 0.10, 0.25, 0.50, 0.75 and 1.0 gph. The nozzle can be used in multiple units, too, when a heat release of over 1 gph is needed!

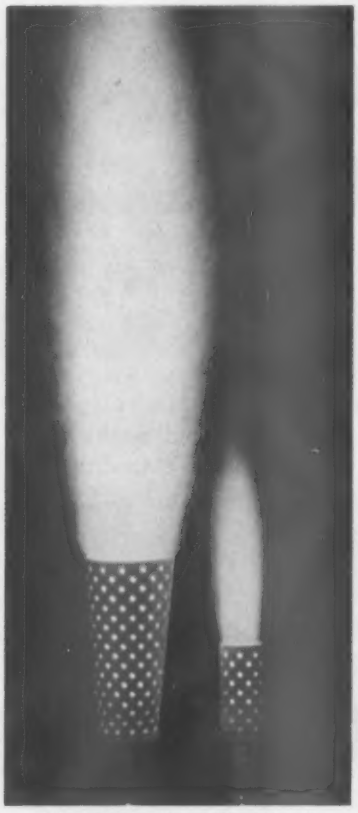
An air-aspirated oil burner—to order. You can construct an air-aspirated oil burner in an amazing number of versions.

To replace gun-type oil burners and gas burners in existing equipment, for example... quickly and easily.

Or for use in new equipment.

Or even in equipment for which fuel oil has never before been practicable!

It can be a vertical burner for use in a water heater. It can be a horizontal burner for use in a hot water boiler or warm-air furnace. It can be a circular model for a unit heater. It can simply be a nozzle fired into a perforated flame holder, for use, let's say, in a domestic clothes dryer or domestic incinerator.



Unusual capacities—1.0 to 0.1 gph

Horizontal-type, air-aspirated oil burner in a triple-unit configuration

Similar units can be combined to attain varying Btu inputs. For example, three horizontal units of 0.18 gph each, to match the 75,000 Btu input of a three-section warm air furnace. The possibilities are almost limitless.

An old flame with new ideas. Truly unique, Gulf's air-aspirated oil burner can be made to replace gas-fired units in furnaces, boilers, water heaters and other equipment already in production.

This simplified oil burner can be adapted to entirely new applications, too—air conditioners, incinerators, dishwashers and clothes dryers, to name a few.

Indeed, the air-aspirated oil burner promises many new product advances, as well as a widely expanded use of fuel oil.

Like more information? Gulf is not in the business of manufacturing oil burners or any kind of oil-heating equipment. We make these developments available to oil-heating-equipment manufacturers on a Royalty Free — Non-Exclusive License basis.

If you would like further information about how you can adapt Gulf's air-aspirated oil burner to your product and equipment needs, simply contact Gulf Research and Development Company, P.O. Box 2038, Pittsburgh 30, Pennsylvania.

Vertical-type, air-aspirated oil burner

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another
TRETOLITE SERVICE
report

NEW PARID DISPERSANT CONTROLS PLUGGING DEPOSITS

To help you overcome the problems in petroleum production, transportation, and storage caused by residual hydrocarbon deposits, Tretolite research has produced a new chemical formulation with a remarkable record of success in field tests—PARID* Dispersant.

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PD-61-1

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from UGC INSTRUMENTS... Dew point readings can now be made accurately, positively and fast with the UGCI DEWSCOPE. No more eye-shifting, no more guessing and no more broken glass stem thermometers! There is no glass stem thermometer on the DEWSCOPE. Temperature is read directly off a meter having a thermistor sensing element that senses only the mirror temperature. A pointer stop has been provided to hold the temperature reading and the range scales can be read at a glance. Faster readings are made with the DEWSCOPE because of its cooling arrangement and the quicker response of the thermistor sensing element. Accuracy is also increased by the optical light source that gives clear distinction between hydrocarbon, water and other dew points. The DEWSCOPE is ruggedly built, requiring little maintenance. Compact in its self-cover carrying case, the DEWSCOPE gives accurate dew point readings fast.

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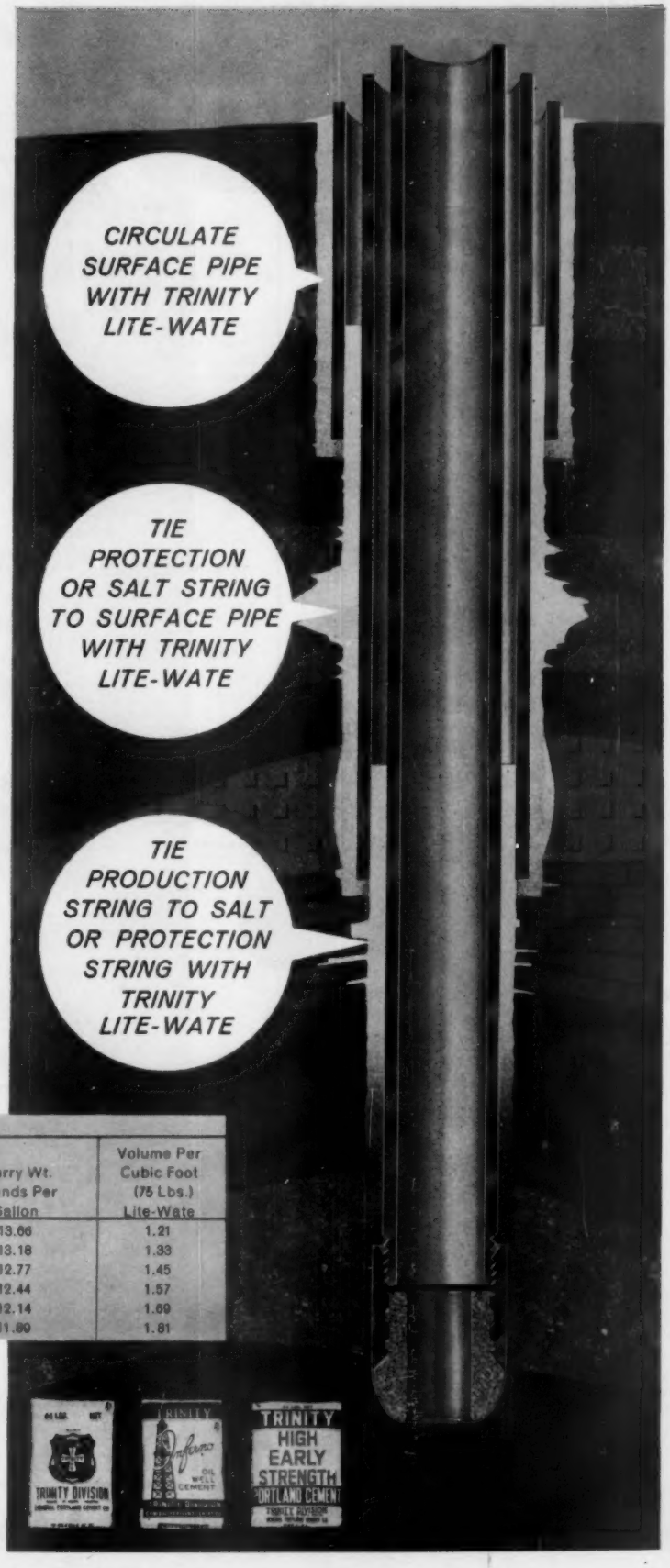
Trinity Lite Wate has been in use for several months in such varying well conditions as found in West Texas, Oklahoma, East Texas, Louisiana, Gulf Offshore and New Mexico, it has produced returns in *every case* where attempted.

SLURRY PROPERTIES

All slurries were mixed in accordance with procedures in the API RP 10B. Slurry weight and volume were calculated on the basis of Lite-Wate specific gravity of 2.80. Absolute volume 3.22 gallon. Absolute volume cubic foot 0.43.

Mixing Water				
Per cent	Gallons Per Cubic Foot Lite-Wate (Dry Vol. 75 Lbs.)	Initial Viscosity Poises	Slurry Wt. Pounds Per Gallon	Volume Per Cubic Foot (75 Lbs.) Lite-Wate
65	5.85	13	13.66	1.21
75	6.75	6	13.18	1.33
85	7.65	4	12.77	1.45
95	8.55	3	12.44	1.57
105	9.45	2	12.14	1.69
115	10.35	1	11.89	1.81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THEY SAY

It lacked tact?

Dear Sir:

This is in reference to the article headed "Geologist shortage predicted" in the October 23 issue of The Oil and Gas Journal (p. 86). I refer to the following sentence from the article:

"During the past 4 years, they say, very few 'bright college students' have enrolled as geology majors."

Even if this statement is a fact it shows a lack of tact. Regardless of whether or not it is a fact, this statement is something less than a compliment to some of the students who did enroll.

Wade H. Hadley, Jr.,
Caracas, Venezuela

Dim view from the deans

Dear Sir:

I recently had the privilege of attending a deans of engineering conference representing approximately 10 southwestern universities and colleges. I represented my university in the absence of our dean. Three conversations developed which I should like to pass along to you.

One dean stated that the petroleum industry was in the same position as the textile industry, i.e., rapidly becoming "obsolete."

I asked how he could hold this view in the light of the population explosion and the inherent increase in energy demands for the future. His reply was that this was "old hat"; that it was exactly what the textile industry thought—increasing population would create increasing demands—but that what really happened was that synthetics appeared on the scene and presto, textile was a dying industry!

Further, he said that the only thing holding the petroleum industry up today was import controls and that this is a strictly artificial means which, of course, can't last.

I then asked my favorite question, one I reserve only for those who have made a **real** study of the problem and are qualified to answer it. I asked, "How long do you think it will be before the oil industry recedes into complete oblivion."

Better Production Tools Through Research

OTIS Equipment NEWS

Volume III, Number 4 Otis Engineering Corporation • Dallas *Production Equipment and Services*

New Low Pressure Pilot System Offers Simplified Multi-Point Protection In Surface Safety Valve Installations

DALLAS—Two new Otis Pilots have been developed that make possible a well safety system that includes: (1) Multi-point protection utilizing a low pressure control line and (2) Single point, single step resetting to place the entire system back in service after a shut-in. The two new pilots are the Type N Otis Actuator Pilot and the Type P Otis Hi-Lo Auto-Reset Pilot. Both can be used with any one of several different Otis Surface Safety Valves.

A Type N and P Otis Pilot System, when combined with the proper Otis Surface Safety Valves, may be installed to protect a single well or a number of wells such as may be located on an offshore platform. The simplest installation is where a low pressure line connects the Type P Pilots at the point where protection is desired and the Type N Pilot on the safety valve. With this type of hook-up pressure changes from the flow line, sales line, heaters, separators, etc. are automatically transmitted from the Type P pilot to the Type N Pilot and Safety Valve.

Evidence of the acceptability of the new Type N and P Otis Low Pressure Pilot System within the various levels of field operating personnel, from superintendents and engineers through pumpers and gaugers, is indicated by the large number of installations made during the short time the equipment has been available.

Application

The application of the Type N and P Otis Pilot System is practically unlimited — from a single well, simple line pressure installation to a complex, multiple well installation that requires a number of protection points for various conditions that could cause serious loss.

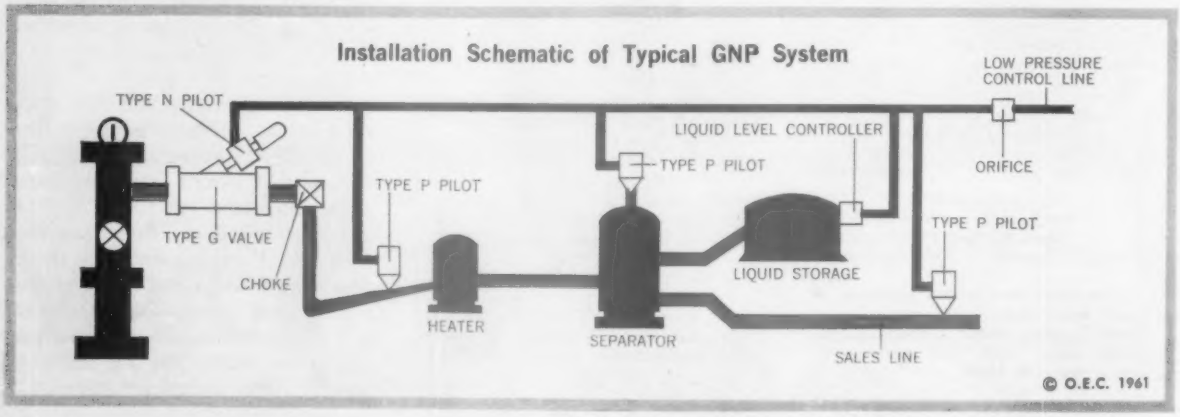
Basically the Type N and P Otis Low Pressure Pilot System is designed to monitor pressure increases or decreases at such points in a surface safety installation as line pressure, separator, LTX unit, free water knockout, heat exchanger and other field processing or production equipment. The system may be installed to monitor various other conditions, also, such as liquid levels, high or low temperatures, volume, viscosity, etc. Electrical control of the system — radio, direct wire or microwave — can be added through the use of solenoids and other electrical equipment. A typical installation, in schematic form, is below.

Here are several of the System's Feature Design Principles —

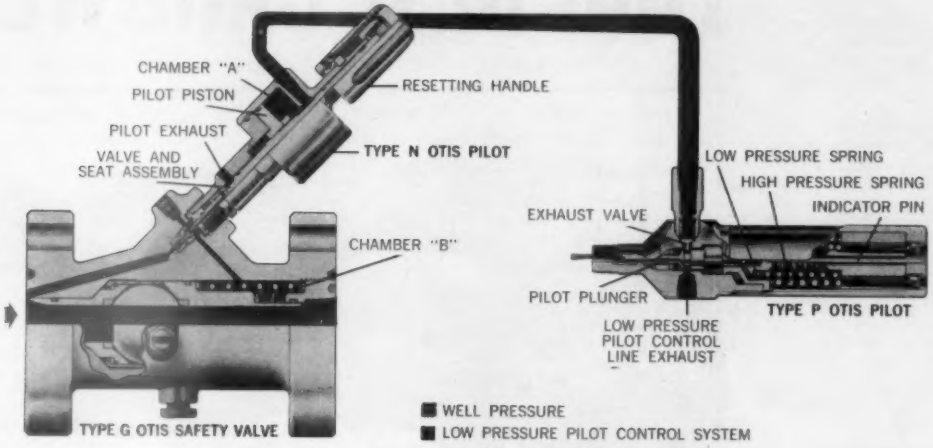
Low Pressure Control Line

The Type N and P Otis Safety System is designed around the use of a low pressure (usually 30-60 p.s.i.) control line that connects the Type P Monitor Pilots with the Type N Actuator Pilot attached to the safety valve. The use of the low pressure line all but eliminates the possibility of hydrates forming and freezing the line — increasing the reliability of the safety installation. When a shut-in occurs, only one high pressure exhaust takes place . . at the safety valve. Choice of source pressure for the control line is optional — pressure is usually taken from the separator or furnished by bottled gas.

The system, in simplified form, monitors pressure changes through the Type P Otis Hi-Lo Auto-Reset Pilot. Pressure fluctuations beyond the preset limitation of the Type P Pilot cause the pressure on the control line to exhaust. Upon exhaust of the control line pressure, the pressure behind the piston of the Type N Otis Actuator Pilot is removed, allowing the pilot to exhaust a pressure chamber in the safety valve. This action serves to create a pressure differential in the safety valve and permits the line pressure to close the valve.



Operating Design Principle of Type GNP System



Illustrated as an example of a Type N and P Safety System is the Otis Type G Valve combined with the Type N and P Pilots. This combination of Otis equipment constitutes a safety system suitable for sensing pressure changes from a wide range of remote points. Although the Type G Otis Surface Safety Valve is used for illustration, the pilots may be used with other Otis Surface Safety Valves.

The Type P Pilot serves to monitor pressure fluctuations (within predetermined limits) in the flow line and/or other lines. Pressure variations, either too high or too low, cause the exhaust valve in the Type P Pilot to unseat and release the constant pressure on the connecting low pressure control line. When pressure is released from the control line, the low pressure on top of the piston in the Type N Pilot (Chamber A) is released and the piston moves back, allowing a ball to seat in the bypass of the Type G Valve. With the bypass sealed, pressure from Chamber B in the safety valve is exhausted through the pilot, creating a pressure differential across the ball and flow line pressure may then rotate the ball to the closed position. The entire system may be reopened merely by turning the resetting handle on the Type N Otis Pilot since the Type P Otis Pilot is designed to reopen automatically when pressures return to normal.

Single Point, One Step Reopening

The entire Type N and P Otis Pilot System is designed to be placed back in service after a shut-in by resetting the Type N Otis Pilot on the safety valve. The operation of the system is controlled from this one point . . there are no complicated procedures or detailed resetting instructions to follow. Merely turn the resetting handle on the pilot in as far as it will go and then back it out. The Type N Pilot also may be used to lock a safety valve installation out-of-service with the safety valve in the open position.

Design Principles of The Type N and P Otis Pilots

The adaptability of the Type N and P Low Pressure Pilot System comes from the flexible design principles incorporated into the two pilots . . Type N Otis Actuator Pilot and Type P Otis Hi-Lo Auto-Reset Pilot. As the name implies, the Type N is an actuator pilot for use on Otis Surface Safety Valves. The pilot does not monitor pressure changes, but acts only as a means for closing and opening the safety valve.

Well pressure is exposed to only a small portion of the pilot's valve plunger area. The internal springs, piston and other working parts of the pilot are normally never exposed to well fluids.

The standard Type N Pilot requires manual resetting. It may be modified for automatic resetting. The Type N Pilot is regularly supplied in a 150:1 operating ratio and installation records show a minimum of maintenance.

Type P Otis Hi-Lo Auto-Reset Pilot is a combination high and low pressure sensing device (0 to 10,000 p.s.i. range). It may be installed at any point in a surface safety valve system where protection is desired. The Type P Pilot does not require manual resetting after a shut-in but is designed to reset itself when the pressure it is monitoring moves back into the range of its settings.

A small pin at the rear of the pilot indicates whether the pilot is set and "in-service" or whether it has operated. Pressure from the monitored source enters in only a small portion of the ½" threaded male connection. Fluids that could corrode or damage the internal working assembly do not enter the main body area of the pilot.

For more details on the construction and operation of the pilot, see illustrations above.

Safety Equipment Recommendations

The Type N and P Otis Pilots are excellent examples of Otis' leadership in safety equipment. Experienced and trained Otis Safety Equipment Specialists have the combined knowledge of the company's more than 20 years experience to draw on when making installation recommendations. Whatever your safety equipment requirements, call the Otis office nearest you or write Otis, Dept. E-4, P. O. Box 35206, Dallas 35, Texas. You'll find Otis Safety Valve Specialists ready to help you . . anxious to serve you . . with the widest variety of production equipment and services available today.

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"Twenty-five years," was his unhesitating reply!

Another dean stated that, in his opinion, the policy of a particular oil company of not hiring petroleum engineering graduates had done more to kill the undergraduate petroleum engineering discipline than any other single factor.

Of course, to this writer's certain knowledge the company does not have this policy and is, in fact, at the present time fanning the flames in the opposite direction.

An associate dean stated that he thought it was unfair to the student to encourage him into this discipline (petroleum engineering) because he knew for a fact that in the oil company for which he had previously worked all the graduate could look forward to was the ultimate position of foreman.

Let's see now, I believe that the dean is the single individual controlling all engineering disciplines in the university, isn't he? Also, isn't he the one in most demand to speak before high school and civic groups on career opportunities?

C. V. Kirkpatrick, Chairman
Division of Chemical and
Petroleum Engineering
Cullen College of Engineering
University of Houston

Clipping hazard

Dear Sir:

The new, stapleless binding of the Big Yellow Book does, I'll readily admit, make it easier to tear out articles for filing. Too, I now notice you are selling editorial file cases to hold the torn out articles. I gather from this that you are interested in making it easy for readers to file parts of the Journal.

If this is true, then why do you always put the lead "exploration" article and the feature geological article back to back? This means that only one, but not both, of the articles can be filed. You generally seem to have full page ads (often back to back) which could be used to separate features.

Since this back section contains features of consistent interest to those of us in exploration, I hope you will make it easier to take advantage of this material.

Richard L. Jodry
Sun Oil Co.
Billings, Mont.

It isn't always possible to back up the exploration lead article with an advertisement, but we do try, whenever possible, to arrange our editorial material for easiest possible clipping and filing.—Ed.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

DECEMBER

4 AIME's Society of Petroleum Engineers, Arizona section, annual meeting, Pioneer Hotel, Tucson.

4-6 Interstate Oil Compact Commission, annual meeting, Denver Hilton Hotel, Denver.

5-6 National Petroleum Refiners, Association, computer conference for refiners, Hotel Tulsa, Tulsa.

JANUARY

7-10 Pipe Line Contractors Association, annual convention, Boca Raton Hotel and Club, Boca Raton, Fla.

8-12 Society of Automotive Engineers, annual meeting, Cobo Hall, Detroit.

16-18 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville, Ky.

17-19 National Association of Corrosion Engineers, Canadian region eastern

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division conference, King Edward Hotel, Toronto.

19 Natural Gas Processors Association, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

24-26 American Society of Mechanical Engineers, second symposium on thermophysical properties, Princeton University, Princeton, N. J.

31-Feb. 1 National Petroleum Refiners Association, Gulf Coast regional meeting, Ben Milam Hotel, Houston.

FEBRUARY

4-7 American Institute of Chemical Engineers, national meeting, Statler Hotel, Los Angeles.

12-13 Missouri Oil Jobbers Association annual convention and trade exhibit, Hotel Chase, St. Louis.

14-16 Southwestern Legal Foundation, annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

14-17 Pipe Line Contractors Association of Canada, Castle Harbor Hotel, Bermuda.

16 Natural Gas Processors Association, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette.

18-22 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, New York City.

22 Chemical Institute of Canada, protective coatings division, Seaway Hotel, Toronto.

23 Chemical Institute of Canada, protective coatings division, Windsor Hotel, Montreal.

28-Mar. 2 American Petroleum Institute, Division of Production, southern district meeting, Rice Hotel, Houston.

MARCH

1-2 Southwestern Legal Foundation, conference on economics of gas industry, Southwestern Legal Center, Dallas.

2 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus, Ohio.

4-8 American Society of Mechanical Engineers, gas turbine-process industries conference, Shamrock Hilton Hotel, Houston.

6-7 National Petroleum Refiners Association, eastern regional meeting, Sheraton-Cleveland Hotel, Cleveland.

13-15 Symposium on Application of Statistics and Computers to Fuels and Lubricants Research Programs, sponsored by research branch, office of the chief of ordnance, Department of the Army, Granada Hotel, San Antonio.

15-16 Society of Petroleum Engineers of AIME, economics and valuation symposium, Dallas.

16 Natural Gas Processors Association, Oklahoma regional meeting, Sheraton-Oklahoma Hotel, Oklahoma City.

19-22 Kentucky Petroleum Marketers Association, management institute conducted by the University of Louisville, Brown Hotel, Louisville, Ky.

21-23 New England Gas Association, annual meeting, Statler-Hilton Hotel, Boston.

21-23 American Petroleum Institute, Division of Production, southwestern district meeting, Lincoln Hotel, Odessa, Tex.

26-29 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, joint annual meeting, Fairmont Hotel, Civic Auditorium, San Francisco.

27-29 American Society of Mechanical Engineers, power conference, Sherman Hotel, Chicago.

APRIL

2-4 National Petroleum Refiners Association, annual meeting, Granada Hotel, San Antonio.

3 Chemical Institute of Canada, chemical economics division conference, Royal York Hotel, Toronto.

4-6 API, Division of Production, Mid-Continent district meeting, Sheraton Oklahoma Hotel, Oklahoma City.

5-6 Society of Petroleum Engineers of AIME, upper Gulf Coast region, drilling and production practices conference, Beaumont, Tex.

9-10 Instrument Society of America, national chemical and petroleum instrumentation symposium, Wilmington, Del.

9-11 Mid-West Gas Association, annual meeting, Hotel Radisson, Minneapolis.

9-12 National Oil Fuel Institute, national oil heat and air conditioning exposition, Chicago.

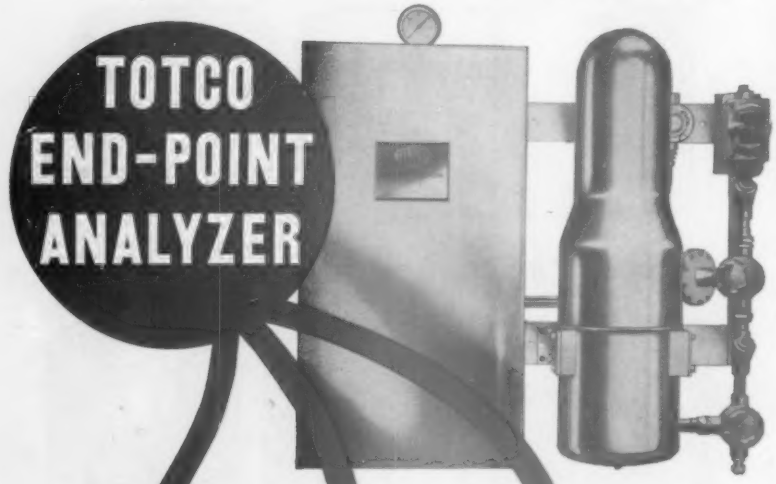
11-12 Petroleum Industry Electrical Association and Petroleum Electric Supply Association, convention and exposition, Dallas.

11-13 API, Division of Production, Rocky Mountain district meeting, Hilton Hotel, Denver.

12-13 Society of Petroleum Engineers of AIME, new petroleum production and reservoir engineering developments, Mayo Hotel, Tulsa.

14-18 Petroleum Equipment Suppliers As-

now on-stream



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Among companies now using one or more Analyzers for monitoring or controlling are:

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Gulf Oil Corporation	The Standard Oil Company of Ohio	Tidewater Oil Company
Mobil Oil Company	Sun Oil Company	Wilshire Oil Company of California
Richfield Oil Corporation	Texaco, Inc.	and many other leading firms.

Applications include quality control of reformer feed, gasoline and distillate components, and "special" products.

Permits closer control to end-point specifications and increased yield. Continuous analysis improves quality. Write for Bulletin 6000-11.

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sociation, annual meeting, Boca Raton Hotel, Boca Raton, Fla.

15-18 American Society of Mechanical Engineers, oil and gas power division conference, Shoreham Hotel, Washington.

17 Society of Plastics Engineers, Philadelphia section, regional technical conference, Sheraton Hotel, Philadelphia.

17-19 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman.

17-19 American Society for Metals, regional conference and exhibition, materials and materials processing for the petroleum, petrochemical and chemical industries, Shamrock-Hilton Hotel, Houston.

23-25 American Association of Petroleum Geologists, Rocky Mountain section annual meeting, Salt Lake City.

24-26 American Society of Mechanical Engineers, production engineering conference, Van Curler Hotel, Schenectady, N. Y.

25-27 Natural Gas Processors Association annual convention, Hilton Hotel, Denver.

29-May 1 Independent Petroleum Association of America, midyear meeting, Hotel Muehlebach, Kansas City.

29-May 1 Empire State Petroleum Association, spring convention, Statler-Hilton Hotel, Buffalo, N. Y.

29-May 2 Liquefied Petroleum Gas Association, annual convention and trade show, Conrad Hilton Hotel, Chicago.

30-May 2 Southern Gas Association, annual meeting, and American Gas Association, transmission conference, Rice Hotel, Houston.

30-May 2 API, Division of Transportation, annual tanker conference, Del Monte Lodge, Pebble Beach, Calif.

MAY

2-4 API, Division of Finance and Accounting, midyear meeting, Americana Hotel, Bal Harbor, Fla.

4 Chemical Institute of Canada, rubber chemistry division, Niagara Falls, Ont.

7-8 Society of Petroleum Engineers of AIME, North Texas section, fifth biennial secondary recovery symposium, Wichita Falls, Tex.

7-8 American Society of Mechanical Engineers, maintenance and plant engineering conference, Royal Orleans Hotel, New Orleans.

10-11 API, Division of Production, Pacific Coast district meeting, Biltmore Hotel, Los Angeles.

11 Natural Gas Processors Association, Permian Basin regional meeting, Lincoln Hotel, Odessa, Tex.

11-12 Kansas Independent Oil and Gas Association, annual meeting, Broadview Hotel, Wichita.

14-17 API, Division of Refining, midyear meeting, Fairmont and Mark Hopkins hotels, San Francisco.

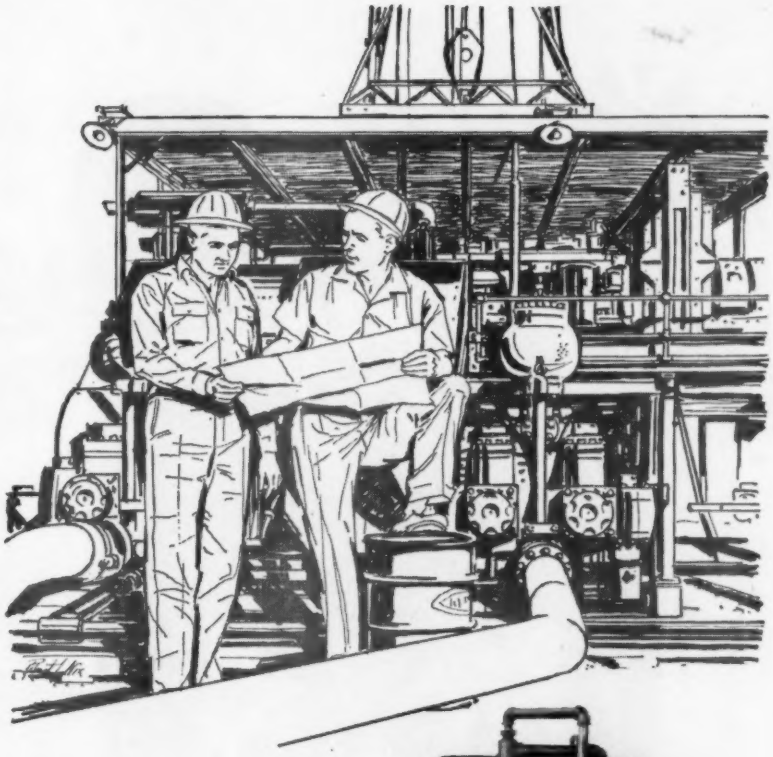
16-18 API, Division of Production, eastern district meeting, Deshler Hilton Hotel, Columbus, Ohio.

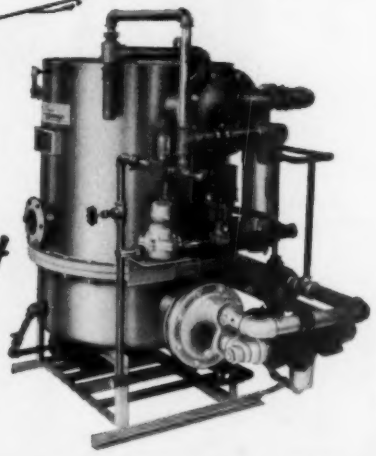
17-18 Society of Petroleum Engineers of AIME, production automation meeting, Hobbs, N. M.

20-23 American Institute of Chemical Engineers, national meeting, Lord Baltimore Hotel, Baltimore.

22-23 National Petroleum Refiners Association, computer conference, Hotel Tulsa, Tulsa.

22-25 API, Division of Marketing, midyear meeting, Queen Elizabeth Hotel, Montreal.





And you can't get far without Fresh Water

That's why more and more producers are making their own fresh water on the spot with the new compact Aquavap evaporator. All you need is a good supply of water, salt or brackish, and an engine to tap for jacket water which acts as the heat source for the evaporator. That's all the heat you need. Inexpensive, simple to install, easy to operate, Aquavap produces water of a purity exceeding U.S. Public Health Service requirements. It is delivered as a packaged unit ready to install. Capacities range from 150 to 12,500 gallons per day of fresh water.

For further details write Dept. O for this new Aquavap Bulletin.

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It's a documented fact: Security now makes the finest bits in the industry. Further, Security *thp* . . . total hole program, using Security bits all the way . . . will save you thousands of dollars per year. Actual in-the-field tests . . . as illustrated by the typical chart below . . . have proved repeatedly that Security bits beat all penetration speed records in comparison with other bits used in similar drilling conditions. Security *thp* will pay off for you, too!

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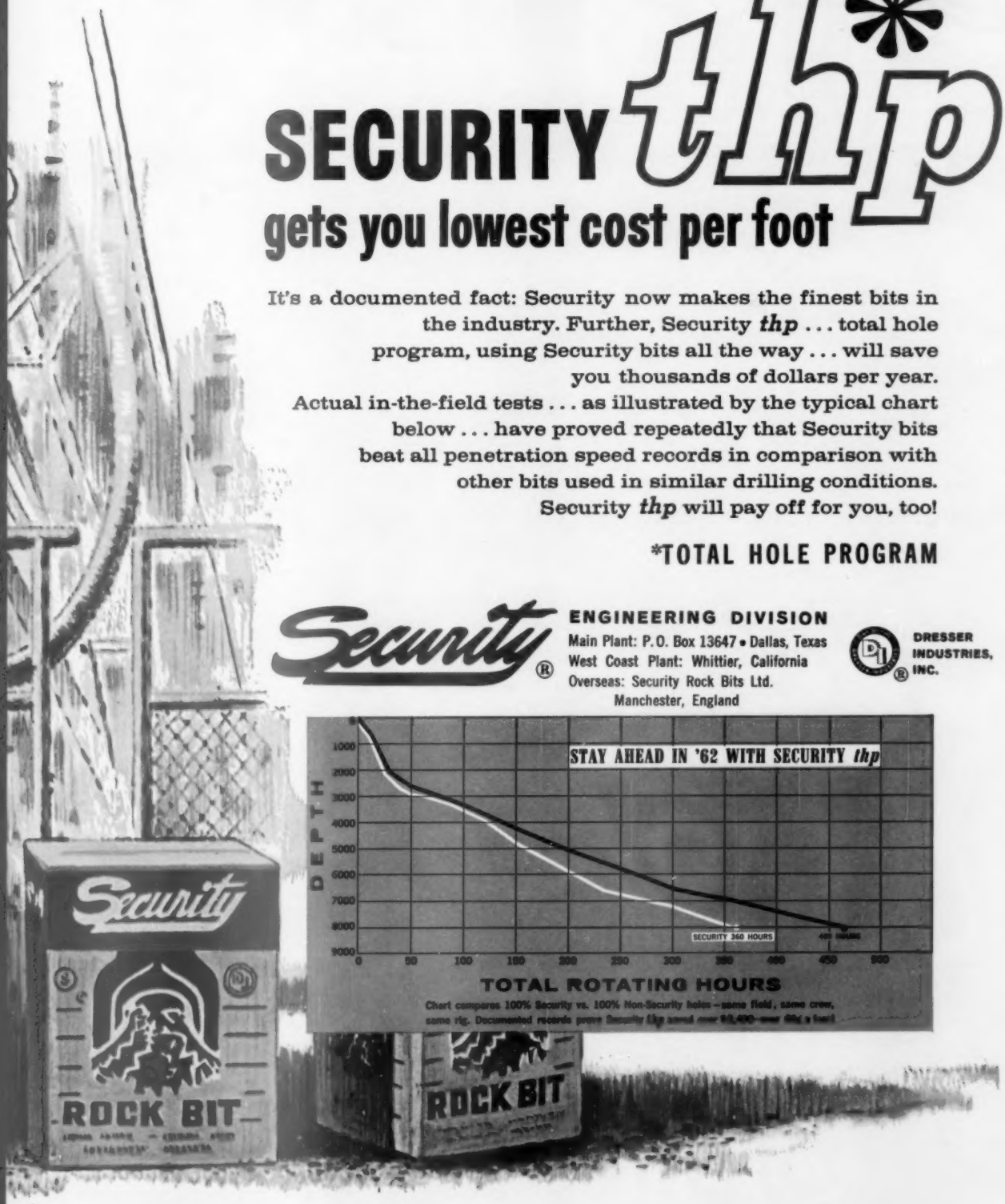
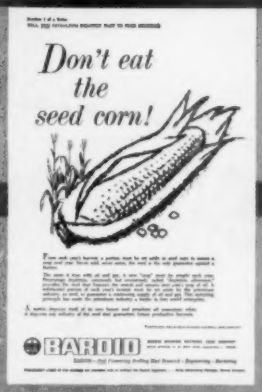




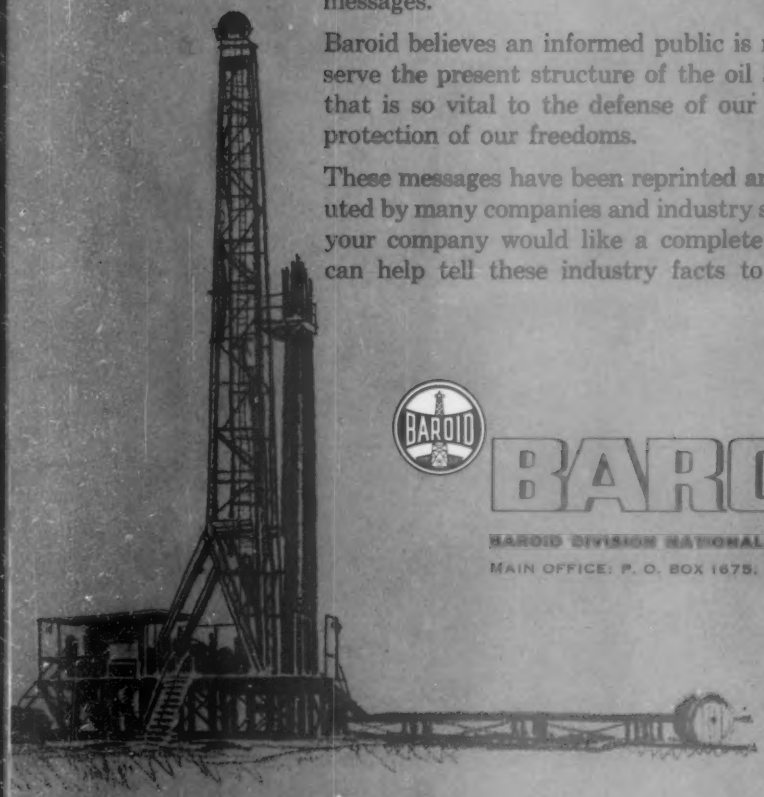
"because we believe

percentage depletion, petroleum tax structure, and profits

are vitally important to maintain a healthy petroleum industry, Baroid presented this series of industry service messages."

Baroid believes an informed public is necessary to preserve the present structure of the oil and gas industry that is so vital to the defense of our country and the protection of our freedoms.

These messages have been reprinted and widely distributed by many companies and industry societies. Perhaps your company would like a complete set so that you can help tell these industry facts to your neighbors.



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BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

61103

THE JOURNAL SAID

50 years ago

December 7, 1911

The Oil and Gas Journal announces the removal of its plant and publication headquarters from St. Louis, Mo., back to Tulsa, where it was published prior to September 1910. First issue from the relocated plant will be dated December 15, 1911.

John D. Rockefeller ends his career as president of Standard Oil Co. of New Jersey following dissolution of the "Oil Trust," effective December 1. He is retiring from all active official participation in the oil business, and is joined by William and William G. Rockefeller, C. M. Pratt, H. M. Flagler, E. T. Bedford, and others long active in the company. John D. Archbold, one of the few remaining members of the "Old Guard," replaces Rockefeller as president of the reorganized Standard Oil Co. of New Jersey.

25 years ago

December 3, 1936

Panhandle Eastern Pipe Line Co. reveals plans for expenditure of more than $20,000,000 for expansion of its facilities in and from the Texas Panhandle to Detroit, Mich. Additional stations and looping to be provided in anticipation of business totaling 400 M.M.c.f.d. of gas.

United Gas Public Service Co.'s recently enlarged Myrtis absorption gasoline plant serving the Rodessa field in northwestern Louisiana sets a new world's record in volume of gas handled in a 24-hour period. Gas handled by the plant in 1 day totaled 180 M.M.c.f.

10 years ago

December 6, 1951

Daily average refinery runs for the week set a new all-time record of 6,757,000 bbl., a gain of 141,000 bbl. over the previous week, and 519,000 bbl. over the same week last year.

Texas-Illinois Natural Gas Pipeline Co.'s $135,000,000 natural-gas-transmission system from Texas Gulf Coast to Joliet, Ill., is placed in operation. This new 1,417-mile, 30-in. high-pressure line is to carry 374 M.M.c.f.d. of gas initially.

A new world's producing-depth record is being set by Shell Oil Co. in Weeks Island field, Iberia Parish, coastal Louisiana. The company's 1 H. T. Gonsulin flowed 188 bbl. of oil daily through 11/64-in. choke from sand at 16,572-16,700 ft. Previous producing depth record was set by the same well when it was completed originally last August at 15,296-15,336 ft.

JOURNALLY SPEAKING

Clearing the air

DURING 1960 there was quite a rash of articles in popular magazines viewing with alarm the growing menace to health caused by pollution of the air in cities.

These articles usually laid the blame to factories and other industrial installations, and many were calculated to stimulate voters into demanding strict control measures.

For the most part, oil refineries were not singled out as the major culprit. But in any community where there is a refinery, the citizens are prone to blame the refinery for any manifestation of smoke, smog, smudge, haze, or peculiar smell in the air.

So the API decided that as a public service as well as a defensive measure it should make a survey of how much refineries are contributing to air pollution and what they are doing about it.

And when it came to picking a man to make a thorough and authoritative survey quickly, only one name stood out. That was D. H. Stormont, refining editor of The Oil and Gas Journal.

Before going to New York to head up all the Journal's refining coverage, Dave Stormont had been West Coast editor and had gone through the battle of Los Angeles smog control from start to finish. Also, 3 years before, he had made a somewhat similar roundup of what the nation's larger refineries were doing to control air pollution.

So, with our management's blessing, Dave went to work. He surveyed refiners' experiences with what they call APC (air pollution control), and came up with enough information to give a complete and revealing national picture. It appeared as a 12-page special report in our issue of February 20, 1961.

The nation's refineries have spent well over 100 million dollars during the last 6 years for new equipment to prevent air pollution. Dave discovered. Most of them now have stopped the emission of the worst types of atmospheric pollutants and are working to control others, such as steam plumes and occasional odors, which are not considered harmful but which may be noticed by the neighbors.

Some of these APC installations have a payout through recovery of salable sulfur or hydrocarbon vapors. But about 60% of the expenditures yield no economic return and were made simply to clear the atmosphere—literally as well as in the sense of public suspicion.

Many of the new units and processes being installed in refineries for other reasons have built-in APC features, but the industry is still spending some $12,000,000 a year for additional measures to prevent air pollution, and also is contributing about $1,000,000 a year for research into air contamination.

In addition, Dave's story pointed out how many refineries are helping local citizens and civic authorities in tracing down other sources of air pollution which formerly were blamed on them. All in all, the report made refineries look like pretty good citizens for any community. His piece was widely reprinted, and has become a reference work for health officials.

Now comes the payoff. At a luncheon in New York last Thursday, Dave stood up and received the Industrial Marketing Award for editorial excellence in original research on a subject of major importance to industry. It was the fifteenth such award the Journal has won in Industrial Marketing's annual business-paper editorial-achievement competition.

—Henry D. Ralph

Baker Wire Line Pressure Setting Assembly, Product 437

Baker Wire Line Bridge Plug, Product 400-N

RUNNING MATES

A Baker Bridge Plug is tough and reliable. So is a Baker Wire Line Pressure Setting Assembly. They're running mates—a matched pair. They've been working together for years, building a reputation for dependability.

The average wells or the hot, high pressure wells—a Baker Bridge Plug masters them all. Whether you measure its life span in hours or in years, it's got what it takes to do its job.

Setting a plug on wire line today is a simple operation, and a fast and sure one. What makes that possible is the Baker wire line setting tool. A good setting tool is as important as a good plug.

Like the bridge plug itself, the setting tool is a Baker innovation. A Baker plug and Baker setting tool work well together because they were designed to do just that.

Leading wire line service companies set Baker Wire Line Bridge Plugs accurately and promptly using the Baker Wire Line Pressure Setting Assembly.

Other models of Baker Bridge Plugs can be set on tubing or drill pipe. They are all made in drillable, corrosion-resistant cast iron for permanent service, and in fast-drilling magnesium for temporary service.

BAKER WIRE LINE BRIDGE PLUGS

BAKER OIL TOOLS, INC. / HOUSTON / LOS ANGELES / NEW YORK

BAKER

Who will man the drilling rigs?

OIL PRODUCERS should take a good look at what is happening to the labor force in the contract services on which they depend, particularly drilling contractors and geophysical companies.

The decline in drilling and exploration during the past few years has depleted the pool of skilled workers in these operations. Many men have left for other occupations, few new ones have been trained, and pay scales have fallen behind other industries.

There is a real threat that, unless this trend is reversed, the industry will soon find itself without the competent men needed to continue operations at their present level, to say nothing of expansion.

THE ATTRITION in the work force of drilling contractors has not been felt by producers because of the decline in drilling activity. But the situation is reaching a critical point.

During the last 5 years, drilling contractors have reduced their payrolls by 17,500 men. These men now have other and probably better jobs, and it is doubtful that many would return to the rigs.

Present crews are getting older, and few men have been trained. Drilling wages and a 7-day-week job on a remote, exposed rig offer little attraction to the youth of today.

True, the drilling business has become more efficient in its use of manpower. While total wells drilled have dropped some 20% below the 1957 peak and footage by about 9%, the number of crewmen employed by drilling contractors has declined 25%. But there is a limit to this, and there are indications that the limit has about been reached.

Crewmen handle expensive equipment, and the fate of tremendous investments by producers often hangs on the amount of skill they apply to their tasks. But competent hands are not attracted by current wages and working conditions.

A SERIOUS EFFORT is being made by contractors to correct this. Well-servicing contractors are trying to raise their pay scale above the level of garbage collectors. Drilling contractors are either raising wages 10% or cutting the work week from 56 to 48 hours, and they may have to do both before long.

If these efforts are to succeed, producers will have to accept higher contract bids. Some farsighted companies have agreed to this and are renegotiating present contracts to cover the added labor costs. The entire industry should go along with this wholeheartedly.

It is poor business to let the competitive-bidding system become the instrument for debilitating the competence of an essential activity. The alternative is for producers to run their own rigs and hire and train their own crews—and that will cost them a lot more in the long run.

"Our Ford Trucks save us 2.3¢ per mile"

says Mr. R. M. Johnson, Vice President, Cosden Petroleum Corporation, Big Spring, Texas

"Our latest six-month truck operating expense summary shows that Ford Trucks cost only 8.6¢ per mile to run compared to 10.9¢ for our total truck fleet. This average covers all of our production, refining, marketing, pipeline and administration trucks. Since these figures include all maintenance and repair work, durability and reliability are two big factors that contribute to lower operating expense.

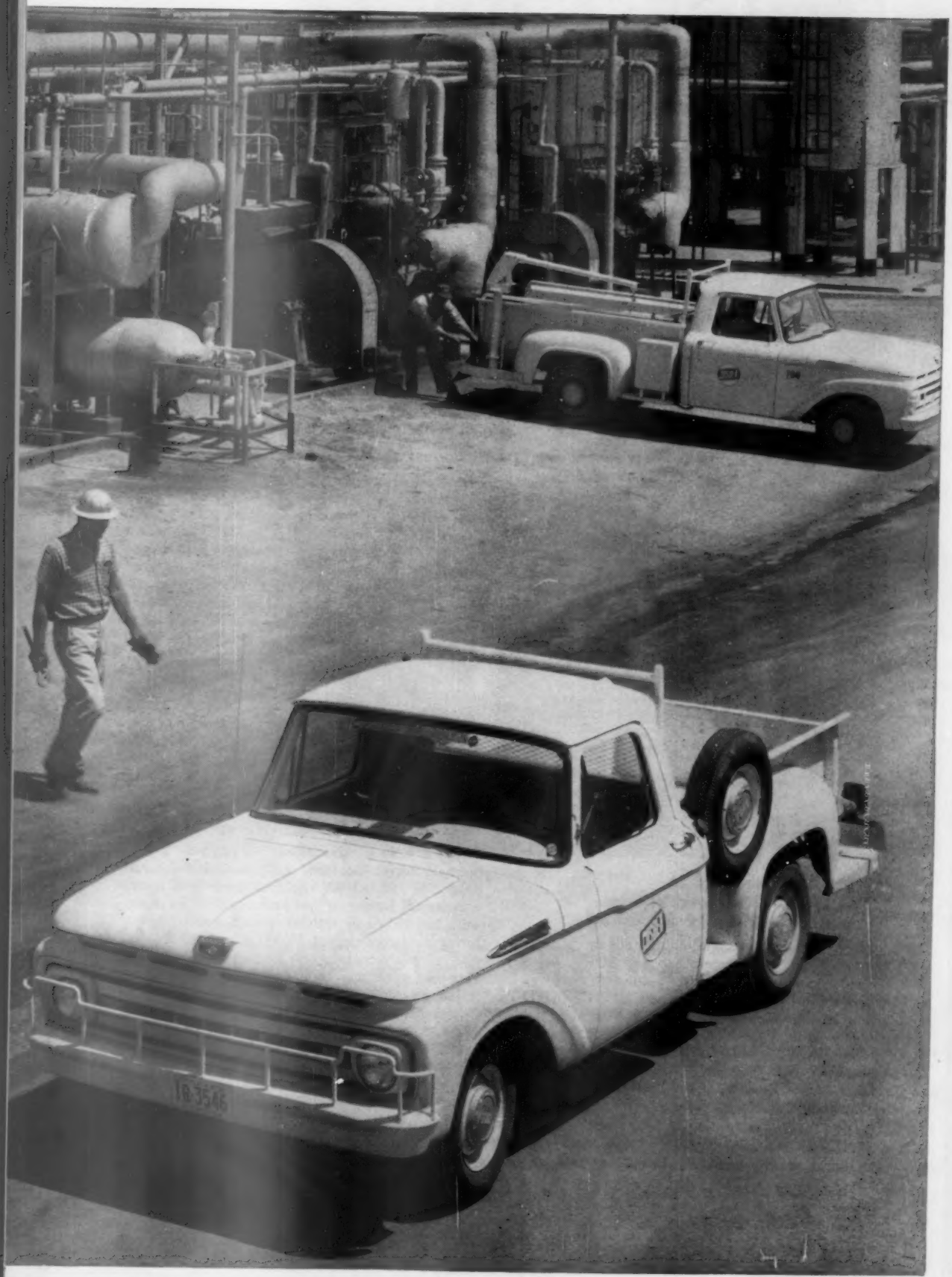
"Ford Trucks lead the fleet in these respects, too. A good case in point is our 1956 Ford F-800 winch truck. Its odometer reads just over 24,000 miles *but the engine has run an average of 7 hours a day, 5 days a week for the last 6 years.* Actually there are well over 8,000 hours on the engine so far, and without a major overhaul . . . this is service that we feel is the equivalent of 300,000 hard miles.

"Also, successive cost analyses have shown that we save money on maintenance and repairs by having all this work done at local Ford Dealer's. This system does away with our need for carrying an expensive parts inventory and reduces our own shop facility and manpower needs. Naturally, our 750 retail outlets do all the routine lubrication, washing and fueling for the fleet."

Solid testimony that Ford's full-time economy only starts with low price!

FORD TRUCKS COST LESS

PRODUCTS OF Ford MOTOR COMPANY



Brass Tacks

FROM HALLIBURTON

Halliburton Fracturing Treatments Produced These Successful Results

Five Zones in Well Treated For Highest Pay in Field

Crane County, Texas. Five intervals were selectively acidized and fractured in this well and it potentialled some 170 BOPD more than other wells in the field. A Halliburton Retrievable Test-Treat-Squeeze (RTTS) Packer with Retrievable Cup-Type Bridge Plug isolated each zone successively during a single trip in the hole. Fluid loss during treatment was controlled. Here are the details:

INTERVAL	ACID TREATMENT	FRACTURE TREATMENT
1	4,000 gal. 15% N.E. Acid	25,000 gal. Waterfrac with gelled brine containing WLC-2 Fluid Loss Additive and 32,000 lbs. 20-40 sand. Injection rate: 31.4 bpm.
2	3,000 gal. 15% N.E. Acid	
3	3,000 gal. 15% N.E. Acid	10,000 gal. Waterfrac same as above with 13,000 lb. 20-40 sand. Injection rate: 25.5 bpm.
4 (Notch)	5,000 gal. 15% N.E. Acid	42,000 gal. Waterfrac same as above with 24,000 lbs. 20-40 sand and 4,300 lbs. rounded walnut hulls. Injection rate: 31.3 bpm.
5 (Notch)	5,000 gal. 15% N.E. Acid	

A Twin HT-400 fracturing unit and a Twin T-10 fracturing unit were used, together with a Model 45 Sand Proportioner. Results from the treatments were rewarding — 570 BOPD of 44.7 API gravity oil on a 32/64" choke.

Multifrac Results in 317 BOPD Flowing Where 110 BOPD Usually Expected

Ward County, Texas. Adjoining wells in the same zone ordinarily produce about 110 BOPD, but a Sandoil multiple fracture treatment on a new well produced the exceptional results of 317 BOPD flowing initially, and 305 BOPD flowing after one month. One perforation was made in each of the three zones. During the fracturing job the number of perforations actually taking fluid were calculated from friction data and formation pressures, then Perfpac balls were injected, one for each zone, when needed. This resulted in the effective treatment of all three zones and apparently reached one that was not treated in the other wells. Fracturing fluid used was 6,000 gal. of refined oil with 9,000 lb. of 20-40 sand. Three Twin T-10 fracturing units, a Proportioner, and a Fracometer were used in the treatment.

Successful Test Run On Aluminum Pellet Evaluation

Uintah, Utah. This job was run to evaluate aluminum pellets as a propping agent in this area. A horizontal, 360° Halliburton Hydra-Jet notch initiated the treatment on a new well in the Green River formation. To increase production from a meager show, a Sandoil treatment was run consisting of 13,440 gallons of No. 5 fuel oil and Rangely shale oil in 50/50 proportions. Sand totaling 2,500 lb. was run at ½ lb. per gallon and followed with 12-16 aluminum pellets at .25 lb. per gal. and then increased to .3 lb. per gal. The treatment was completed with 8-12 pellets run at .35 lb. per gal. The well responded with increased production immediately, and after two months, was producing 250 BOPD and 200 BWPD. The actual maximum production is unknown, but this is one of the better wells on the lease.

Aluminum Pellet Tail-In Increases Pay Over Offset

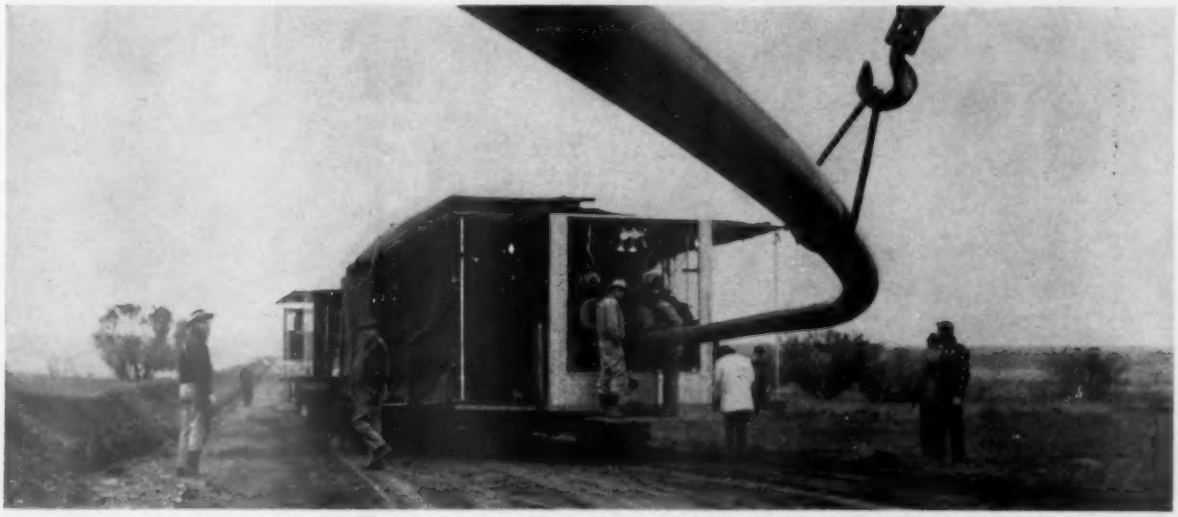
Stephens County, Oklahoma. An old well in the Springer formation from 5,396 to 5,418 ft. was producing 145 BOPD. The operator decided upon a treatment similar to that performed on an offset well, but tailing-in with aluminum pellets. Fracturing fluid consisted of 20,000 gal. of 9.2 lb. per gal. salt water containing a low fluid loss additive. Propping agent was 18,800 lb. of 20-40 sand followed by 1,600 lb. of 12-16 aluminum pellets. Equipment used on the job included two Twin HT-400 fracturing units and a Model 70 Proportioner. A Halliburton Fracometer continuously recorded progress of the treatment. The well responded with production of 251 BOPD, an increase of 106 BOPD.

THESE AND MANY OTHER advanced fracturing techniques are available for your wells. Your Halliburton representative will be glad to discuss them with you.

First and Foremost in Formation Fracturing

FRACTURING SERVICES

MOBILE MILL looks like a short, slow freight train moving down right-of-way. Leading parade is power unit, followed by mill unit where pipe is formed and welded. The combine is steered from operator's compartment.



REAR VIEW shows formed pipe, supported by sideboom tractors. Mill here has just formed 45° bend. Revolutionary new machine holds promise of great change for pipeline industry.

Mill makes pipe on right-of-way

Paul Reed, pipeline editor, and John O'Donnell, assistant pipeline editor.

UP TO 4,000 ft. of 8-in. pipe was rolled, welded and strung on a pipeline right-of-way in a single day in North Texas last week.

This history-making event may become the most revolutionary development in pipeline construction. Doing the job was the first mobile pipe mill ever built to move along as the pipe is made.

The mill makes line pipe from coils of hot-rolled steel, moving along the right-of-way at the speed of pipe manufacture.

It is a success in its initial on-the-job test. Finished pipe in lengths of 800 to 900 ft. was being strung along the right-of-way at the rate of 20 ft. per minute.

The mill is designed to produce 90 ft. per minute, or 5,400 ft. per hour. However, the operators do not expect to exceed a rate of 1½ to 2 miles per day in this first operation.

Its potential contribution to pipeline construction is enormous. It could greatly reduce freight and pipe-laying costs. It could eliminate stringing and line-up gangs. It could reduce the number of welds from more than 100 per mile for 40 to 50-ft. joints to 6 or 7.

The greatest advantage of the mobile mill will come in those areas where construction is far removed from standard mill facilities. Instead

1 Closeup shows coil of flat steel feeding into mill. Rolled and welded pipe is leaving mill at right. Mill can handle coils of steel weighing up to 10 tons—enough to make 800 to 900 ft. of pipe.

4 Welding step. Coil at left induces electric field on outside surface of pipe. Coil on mandrel induces field on inside surface. Fields converge at point of welding. Reel at right winds flash, or upset, stripped off by cutting tool.

5 Smoothness of weld is shown as pipe leaves welder. Removal of outside upset leaves shiny weld surface.

of moving from 16 to 20 fully formed joints of pipe, it will be necessary to move only one compact coil. The saving in space and shipping costs would be attractive.

First project. This first mobile mill was designed to manufacture pipe as large as 10¾-in. diameter with wall thickness up to ¼ in. The second will be capable of rolling sizes up to 16 in. in diameter.

The mill was designed and built by Mobile Pipe Corp., an affiliate of Gilmore Steel Corp., San Francisco. Its inventor is Clyde Vassar, a mechanical engineer and pipe mill consultant. Development of the unit for pipeline construction is being sponsored under contract by Williams Brothers who are building a 30-mile, 8-in. segment of a products line for Cherokee Pipe Line Co.

Last week the mill was working northeast of Wichita Falls, near the city's airport. By Tuesday, it had completed approximately 3 miles.

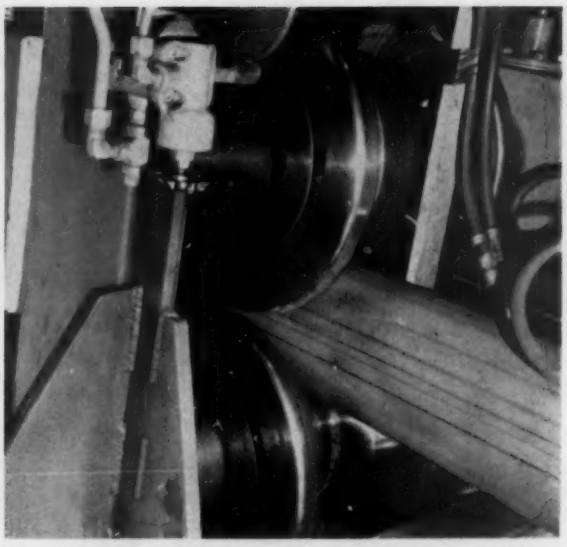
The pipe is 0.156-in. wall thickness, X-52 grade. Each spool or coil of flat steel weighs from 7½ to 8 tons and can be rolled into 800 to 900-ft. sections welded by a high - frequency electric - resistance welding process.

The mill is equipped with a bending device and can make horizontal or vertical bends as it moves. Last Tuesday it negotiated a better than 45° horizontal bend.

The over-all apparatus utilizes conventional time-tested mill components and procedures. These procedures include: (1) roll forming, (2) radio frequency resistance of 400,000 cycles heating of the skelp edges; (there are electric fields on the inside and outside surfaces of the pipe); (3) continuous roll forging or welding, (4) removal of the weld upset, and (5) sizing the welded pipe.

As the steel moves through the mill, the mill is moved in the opposite direction at an equal speed.

2 Inventor of mobile mill is Clyde Vassar, standing here beside coil of hot-rolled steel.



3 Pipe is formed as sheared edges are brought together in forming equipment in mill.

6 Finished pipe emerges from rear of mill. B. E. Barnes, Williams Brothers senior vice president for domestic operations, is in charge of mobile-mill operation.

7 Internal upset is sheared off by cutting tool, but remains in pipe. Here it is removed by Vincent Sullivan, Gilmore Steel representative, after long joint is finished.

The mill. To facilitate movement from one location to another, the mill is composed of two units called the power unit and the mill unit. Between the two units is mounted a coil cradle which is attached to the mill unit. The coil cradle holds the steel on an expanding mandrel which pays out the steel to be formed.

Mobile quality-control and field-maintenance equipment accompany the mill at all times.

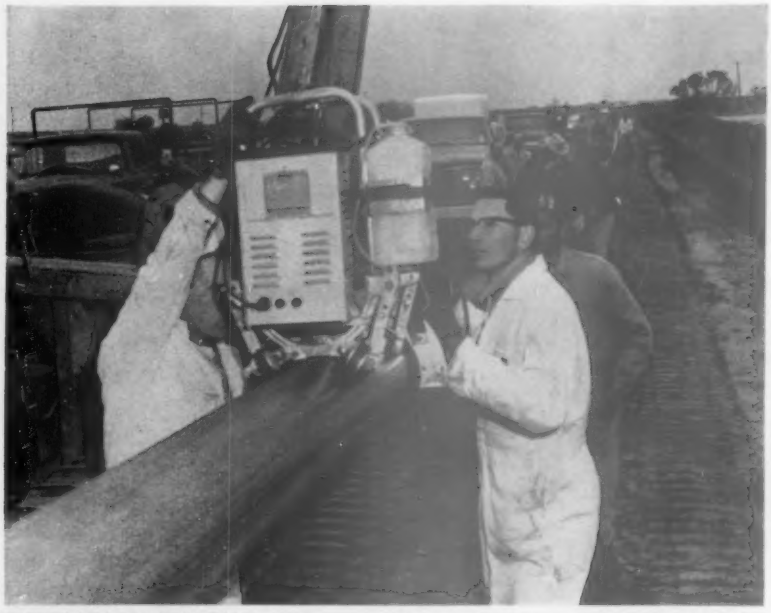
Principal components of the mill are the mill-entry equipment for unreeling skelp from the coils, the pipe-forming equipment, and the welding facility. The mill-entry equipment consists of an expanding mandrel-type coil box, powered pinch rolls, a powered five-roll leveler, a hydraulic shear and an automatic DC welder for joining the coils. The welder is not used when the mill is self-threaded.

Edges of the steel are rotary-sheared at the mill and are scarfed in the machine. This helps to assure flat surfaces of the pipe edges as they are drawn together for welding.

Pipe forming. In the mill forming section, the pipe is formed by means of three top driven breakdown passes, incorporating continuous contact forming and two fin passes which have both the top and bottom rolls driven. The fin rolls have idling flanges to reduce the possibility of roll marks. All rolls are individually powered.

Welding. The welding equipment consists of a radio-frequency welder manufactured by the Tocco division of Ohio Crankshaft Co. Current is applied to the steel by an encircling coil which concentrates the current by means of resistance at the closure or welding point. The temperature at the weld point approaches 2,600° F.

Both the internal and external weld upsets are removed by car-



ULTRASONIC INSPECTION is made on all pipe coming from mobile mill. Vehicles in far background include a mobile laboratory and a mobile maintenance shop.

bide cutting tools. A cutting tool, mounted on an arm extending beyond the weld area, removes the internal upset.

The continuous forge weld is made by the weld pressure rolls which are designed to place the maximum flash on the outside of the pipe.

Sizing is performed in three four-roll stands. The unit is electrically powered to make side, over, and sag bends as required by the terrain.

The mill has roof-mounted hinged convectors and condensers which are part of the refrigeration system. This system cools the welding coil and the oscillator tube in the welder. Roll lubrication is supplied by an air-mist applicator which atomizes water-soluble oil.

Power unit. The power unit is propelled by a Caterpillar tractor powered by a d.c. motor which also supports the front of the unit. A set of Athey tracks supports the rear.

Power units consists of two Caterpillar D353 engines, one directly driving a 170-kw. d.c. generator and the other one a 250-kva. a.c. alternator and a 40-kw. engine-alternator. A 600-gal. diesel-fuel tank is built into the steel frame of the power unit.

The power unit also has two control cabinets, a Tocco d.c. rectifier cabinet and the operator's compartment. The tractor operator merely steers the power unit since the laying speed is controlled by the welder operator as he varies the mill speed.

Future plans. To help reduce human errors, future units will have radiomatic heads mounted over the weld pressure rolls.

They will record the weld temperature that is fed to an electronic mixer which also records the mill speed. Thus welding temperature will be kept constant automatically although the mill speed is varied. Welding current is determined by mill speed. The welder is now being operated manually.

A mobile laboratory accompanies the mill at all times. This lab, installed on a truck, has polishing machines, a microscope with a Polaroid camera attachment to photograph each microetch for a permanent record, a tensile testing machine with extensometer and flattening test attachment, a test specimen milling machine, sulfur print equipment, plus the usual etchants, molding equipment, etc.

A separate 5-kw. power plant supplies electricity for the mobile laboratory and for the Sperry ultrasonic test which is operated with a hand crystal. In the future an ultrasonic tester may be mounted in the mill itself if a transducer wheel pickup, now under test, is successful. Chemical check analysis will be made by independent laboratories.

A fourth piece of equipment is a truck-mounted maintenance shop, for the continuous upkeep of the outside trim tools and edge conditioning tools as well as electrical and mechanical equipment.

Mobil returning to Alaska

Company plans to drill again on Alaska Peninsula south of where a $4-million exploratory play failed in 1959.

AFTER a 2-year absence, Mobil Oil Co. has decided to take another fling at trying to find oil in Alaska.

The company has applied for a development contract on 450,000 acres on the Alaska Peninsula. The acreage is south of an area where the company drilled two dry holes in 1959.

The new spread, like the old, is on leases held by a group of independent operators. The north boundary of the new contract area overlaps the southern boundary of the old by 6 miles, but all of the new acreage is south of Becharof lake.

If the contract is approved by Interior, Mobil will spend $200,000 during the first year of the contract and drill at least three wells during the next 4 years.

Principal leaseholders on the acreage Mobil will drill are Great Basins Petroleum Corp., Reserve Oil & Gas Co., Ambassador Oil Corp., Republic Natural Gas Co., Hudson Gas & Oil Corp., and Lehman Brothers. The group holds about 600,000 acres on the peninsula.

The new acreage is in the Bristol Bay area of Alaska and is accessable from the west coast of the peninsula. Mobil's previous drilling—a $4-million plus venture—centered around two locations near the western end of Becharof lake in an area which was first drilled back in the 1920's.

A look at 1960 stripper-well production

State—	No. of stripper wells	Production, 1960 (bbl.)	Abandonments	Avg. daily prod. per well (bbl.)	Prod. acres	Reserves (Thousands of bbl.) Primary	Secondary	Total 1-1-61
Arkansas	4,539	7,924,719	102	4.79	61,755	38,758	41,480	80,238
California	21,052	56,182,250	342	7.31	132,210	706,192	531,410	1,237,602
Colorado	410	1,411,731	27	9.43	15,930	17,113	2,165	19,278
Illinois	28,904	76,448,545	843	7.25	576,323	*555,642	.....	555,642
Indiana	4,978	11,762,215	57	6.47	79,890	60,736	36,395	97,131
Kansas	40,524	75,024,638	1,109	5.07	1,075,218	466,690	81,545	548,235
Kentucky	14,809	20,073,972	1,145	3.71	37,500	118,000	88,500	206,500
Louisiana	9,360	11,750,069	349	3.44	204,050	92,626	82,840	175,466
Michigan	3,396	15,899,206	143	12.83	136,580	91,858	117,472	209,330
Mississippi	227	795,433	9	9.60	8,488	6,363	.....	6,363
Missouri	119	74,575	2	1.72	1,510	670	.....	670
Montana	2,829	826,432	248	0.80	106,903	40,281	110,138	150,419
Nebraska	69	133,057	63	5.29	3,610	1,064	1,750	2,814
New Mexico	5,798	8,970,284	564	4.24	224,720	71,760	37,000	108,760
New York	14,600	1,813,430	1,600	0.34	37,000	55,900	23,500	79,400
North Dakota	118	270,000	12	6.27	10,606	2,160	3,300	5,460
Ohio	16,922	5,405,304	614	0.88	150,000	68,572	5,750	74,322
Oklahoma	65,688	95,054,237	2,384	3.96	1,168,484	602,464	594,494	1,196,958
Pennsylvania	61,896	5,950,523	2,736	0.26	625,732	107,632	†374,161	481,793
Tennessee	31	19,708	7	1.74	155	200	45	245
North Texas	28,434	43,037,592	618	4.15	434,100	389,405	363,120	752,525
West Central Texas	11,743	15,573,063	601	3.63	317,507	127,895	113,390	241,285
Other Texas	50,716	111,664,728	1,544	6.03	1,334,755	951,911	404,020	1,355,931
Utah	16	12,023	.....	2.06	860	96	.....	96
Virginia	5	2,024	8	1.11	100	15	.....	15
West Virginia	12,699	2,300,000	212	0.50	207,076	35,432	52,000	87,432
Wyoming	3,471	5,771,226	95	4.56	111,620	57,710	330,000	387,710
TOTALS	**403,323**	**574,150,984**	**15,434**	**3.90**	**7,062,682**	**4,667,145**	**3,394,475**	**8,061,620**

*Secondary reserves of projects now in operation included with primary reserves. †Estimated probable secondary recovery reserves.

Stripper-well production climbs 7.6%

Latest study shows two out of three U. S. oil wells are strippers making less than 10 bbl. a day. All together they produce more than one-fifth of this nation's crude and have one-fourth of the domestic reserves.

PRODUCERS last year abandoned 15,434 marginal oil wells. But 26,222 wells were added to the stripper category.

This boosted the number of stripper wells in the U. S. from 392,535 in 1959 to 403,323 at the start of this year.

Stripper production jumped 41 million barrels to about 574 million barrels in 1960.

Total reserves of stripper fields rose past 8 billion barrels—an increase of some 600,000,000 bbl. over 1959.

This means that at the first of this year stripper wells represented 68% of all producing oil wells in the U. S., and they accounted for 22% of total U. S. output. Stripper fields had 25% of total U. S. reserves.

The annual stripper-well survey—a joint effort of the Interstate Oil Compact Commission, the Independent Petroleum Association of America, and the National Stripper Well Association—also makes these points:

The per-well average in 1960 of 3.90 bbl. daily is 0.18 bbl. higher than the previous year.

Abandonments last year ran 4,000 above the number abandoned in 1959.

Stripper-field reserves break down to 4,667,145,000 bbl. of primary reserves and 3,394,475,000 bbl. of secondary reserves.

Productive acres in stripper fields climbed from 6,523,009 in 1959 to 7,062,682 last year.

The report classifies stripper wells as wells in nonprorated fields which average less than 10 bbl. a day per well. It also includes fields which once were classified as stripper but because of secondary-recovery operations are now producing more than 10 bbl. daily.

In some cases, wells are classified as strippers because they produce a great amount of water or because production is low in proportion to well depth.

Texas remained the top stripper production state with 170,275,383 bbl. last year.

Michigan had the highest per-well output: 12.83 bbl. daily.

New offshore hope: floating drill barge

New Orleans company is modifying ordinary submersible barge so it can drill while afloat. If experiment pans out, any depth in offshore waters could be handled by barges now confined to shallow waters.

THE FUTURE of offshore drill rigs may well change complexion as a result of an experiment launched last week by Blue Water Drilling Co. of New Orleans. The company is modifying a garden-variety submersible drilling barge so it can drill while afloat.

Till now, drilling from the floating position has been a feat reserved only for a handful of "ships."

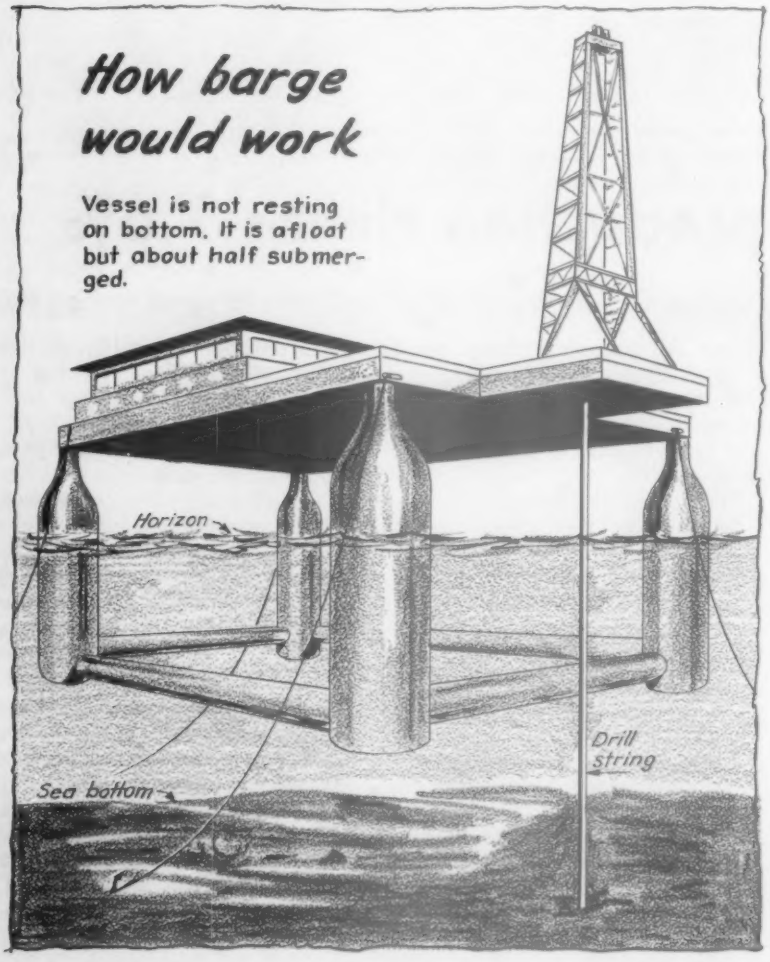
If Blue Water's experiment is successful—both economically and technically—the deepest of offshore waters will be opened to almost immediate drilling by a number of work-a-day rigs now toiling in shallow waters. Success would also allow the offshore contractor to compete with a single barge in water from 30 ft. deep to any greater depth.

The Blue Water barge—the company's Rig 1 — arrived at Pascagoula, Miss., last week to enter the shipyards for a "major modification." About January 1, the rig is to move onto a location off Louisiana to commence a well for Shell Oil Co.

The concept of floating drilling is usually linked to another item of high interest offshore—the underwater completion. Shell acknowledges it plans to contract the reconditioned rig for floating drilling, but has not announced whether underwater completion will be attempted. And no announcement has been made of the water depth on the proposed location.

Buoyant bottles. Not all submersible drilling barges lend themselves to the same kind of modification planned for Blue Water Rig 1. This unit is built with a large "jug" or "bottle" on each of its four corners. General design is that pioneered by Kerr McGee Oil Industries' Rig 46 (OGJ, Dec. 24, 1956, p. 58). More than a half-dozen other such barges are currently at work on the Gulf Coast.

Because the jugs are of large diameter, they have great buoyancy for each foot of submersion. As a


How barge would work
Vessel is not resting on bottom. It is afloat but about half submerged.
Horizon
Drill string
Sea bottom

CUSS II may drill

GLOBAL Marine Exploration Co. has launched the oil industry's first floating drilling ship designed and built specifically to operate in water of any depth.

The CUSS II, an updated version of its history-making sister ship, the CUSS I, has been outfitted to drill in 500-ft. waters for the present and will be ready to operate in Gulf Coast or Caribbean waters by January.

But if its owners are successful in competitive bidding, they will put it to work drilling the intermediate Mohole. The CUSS I did the first Mohole drilling.

The CUSS II launching occurred at the Madisonville, La., shipyard of Equitable Equipment Co., just above Lake Ponchartrain in the Ichefuncta River. The ship still requires some fitting out before going on duty.

While basically similar to the CUSS I, which drills through a center slot, the new vessel has greater draw-works capacity, more hookload capacity, and more cargo space

result, they tend to keep the barge level and stable regardless of how little or how much of the barge is submerged.

Originally, the corner jugs were intended to solve a critical problem in submerging and refloating. Several older-design barges proved nautically unstable during these operations; several have been damaged badly or capsized completely while submerging or refloating.

Not only have barges equipped with jugs been quite stable generally, they have been moved onto and off location more quickly than some other submersibles.

As a result, several submersible rigs which were originally built without jugs have been taken back into the shipyards in the past 2 years to have these big stabilizers put on.

It was only natural that someone should think of attempting to drill while the jug-equipped barge is in a half-submerged position. This is what Blue Water proposes.

Cost of modifying Blue Water Rig 1 has not been announced. Other contractors have estimated the expense at near $1,000,000.

new Mohole test

(OGJ, Aug. 7, p. 89). It is designed to be self-propelling if need be, but is not being outfitted to move under its own power for the present.

The owners say that in deep-water drilling, such as the Mohole would require, the ship can be dynamically positioned to remain stationary over the hole. They did not disclose how this would be done. The CUSS I used four outboard motors.

Entry of the CUSS II into the offshore drilling industry means that leases in much deeper waters can be tested.

The drilling ship is 267 ft. long and 58 ft. wide and has a displacement of 5,500 tons. This is slightly larger than the CUSS I, a converted Navy YF (yard freighter).

Larger cargo capacity means it can rack pipe horizontally in trebles and handle it automatically. It can carry 15,000 ft. of 5½-in. drill pipe and 12,000 ft. of 9⅝-in. casing.

The ship has diesel-electric power which can be used for self-propulsion.

New deep production record set in Texas

GULF Oil Corp. has completed Texas' deepest producer, a 17,200-ft. gasser 13 miles southeast of Pecos in Reeves County.

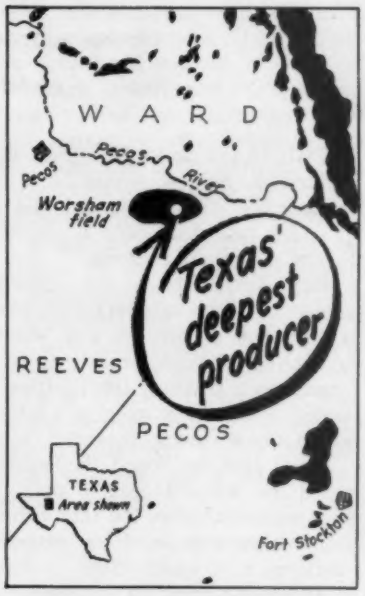
The well is notable also for being the first producer from the Ellenburger formation in the Delaware basin, located in Far West Texas and southeastern New Mexico.

The 2 R. Cleveland tested at a calculated open-flow potential of 37 million cubic feet of gas through perforations bottomed at 17,200 ft. Gulf did not disclose the thickness of the pay. The well was drilled to 17,720 ft. and cased to 17,716 ft.

The producing depth is more than 500 ft. greater than the former record holder, Atlantic Refining Co.'s 16,680-ft. 1 Kelly, completed last year in adjacent Pecos County from the Montoya formation (OGJ, June 13, 1960, p. 74, and Sept. 12, 1960, p. 84).

Prior to the Atlantic discovery, the deepest Texas producer was Pure Oil Co.'s 1 Houston Farms Development Co., a Galveston County well completed in 1959 in the Frio at 16,264 ft.

Gulf's new well is located on the southeast edge of Worsham (Delaware) field, which produces from about 5,000 ft. Gulf did not say whether the 2 R. Cleveland found production at this or other levels.



The drilling contractor was Parker Drilling Co., Tulsa.

Arctic wildcat may go below 10,000 ft.

THE first Canadian Arctic island wildcat was nearing its 10,000-ft. target last week.

Dome Petroleum, Ltd., operator for the 17-company combine taking part in the million-dollar test, last week reported a depth of 9,133 ft. A decision was expected by early this week on whether to take the wildcat below 10,000 ft. Additional supplies would have to be flown in.

Peter Bawden Drilling, Ltd., the contractor, spudded the test 2½ months ago at Melville Island some 1,500 miles north of Edmonton.

By November 2, the test was down to 7,162 ft. Depth on November 15 was 8,202 ft., and was 8,764 ft. on November 21.

The wildcat is the first of several planned to explore the Arctic islands.

California storm sinks drilling ship

A 900-TON drilling ship operated by Global Marine Exploration Co. sank off the coast of Santa Barbara County, California, last week during a severe storm.

The ship, SM-1, was swamped by 20-ft. waves whipped up by 70-knot winds. The big factor which led to the sinking was loss of pumping and generating power when the waves flooded the ship. Eight crewmen got off safely.

The SM-1 was on a development drilling program for Texaco Inc. in Parcel 2 when the big storm came up. She was about a mile offshore, but was not making hole at the time of the storm.

Global Marine's CUSS I, located nearby, rode out the storm.

Steed group backing cut in imports

House subcommittee convinced, after imports hearing, that tightening of controls is needed. White House will get recommendation to this effect.

THE House Small Business subcommittee No. 4 wound up its hearing last week convinced that a strong case had been made for tighter oil-import controls.

Rep. Tom Steed (D. - Okla.), chairman of the subcommittee, said a transcript of the hearings would be sent to the White House, accompanied by a covering letter strongly urging a reduction in import totals as a national security measure.

Steed said he hoped this would reach the White House in time to be considered before the administration makes a decision on program revisions now under study.

Steed also revealed that his subcommittee will meet again in January to consider the impact of any changes the administration might have made in the program for 1962.

The implication was clear that the subcommittee will be sharply critical, if the administration has not tightened controls to eliminate what Steed feels are loopholes in the present program.

At the January meeting, Steed will likely invite other congressmen to voice their views, thus adding weight to the subcommittee's position.

Significance. The testimony presented at the Steed hearing did not differ in any major respect from arguments presented all along, including views aired at similar hearings by the Department of Interior earlier this year.

The significance, therefore, was that this hearing was before a congressional group rather than an administrative group. It means that Congress is getting more involved in the issue than at any time since 1958.

Since the inception of the mandatory control program, Congress has largely been content to leave program decisions to the administration. But that picture is changing.

A push for legislation may develop next year, but whether it does or not, there is little doubt that the administration will feel effects of increasing congressional pressure.

Rep. Tom Steed
. . . sees loopholes in program.

It is quite likely, too, that oil-import controls will become involved in the larger battle looming over the entire reciprocal trade program.

Steed apparently foresaw these developments and therefore sought to build a hearing record which could be used in further imports discussions in Congress next year.

It appeared, too, that Steed was hopeful the hearings would help develop a broader public understanding of the petroleum industry and its close relation to the nation's security and economic welfare.

All in all the hearing provided an opportunity for the coal and petroleum industries, particularly the domestic producers, to tell their stories.

The showdown. There are growing indications that the administration and Congress are developing divergent views on trade policies generally, including oil.

Administration spokesmen are voicing more and more the need for encouraging a freer flow of goods throughout the free world. The development of the European common market and the increasing impact of soviet trade practices are cited as among the reasons why this nation must liberalize its trade policies.

At the same time, many congressmen are under growing pressure from business, industry and labor in their home districts to protect them against the inroads of foreign goods.

Also, some are questioning whether this nation's aid and trade program is making friends for the U. S. or simply creating more problems for everyone.

A showdown appears inevitable, and the future of oil-import controls will be riding on the outcome.

Points of view. The positions of most segments of the oil industry were spelled out clearly during the hearing before the Steed subcommittee.

Domestic producers provided an array of arguments and figures designed to show that by all the accepted yardsticks, the domestic-oil-producing industry is in the doldrums and that this can only result in a decline in the domestic exploration, drilling and production needed to maintain safe supplies of petroleum to meet future emergency requirements.

The Independent Petroleum Association of America and the Texas Independent Producers and Royalty Owners Association led producer groups in calling for a sharp rollback in present import levels—something around 200,000 to 250,000 bbl. daily below the present import flow.

They also urged elimination of all exemptions, saying that these provide loopholes which tend to distort and destroy the control program.

State regulatory officials from producing areas strongly backed the producers. In some cases they expressed even more strongly the opinion that oil imports are crippling the domestic industry and are disrupting conservation activity, state revenues, the economy of many communities, and creating increas-

ing unemployment.

Independent refiners supported the control program, and defended the practice of granting quotas to inland refiners who normally do not process imported crude.

Major companies, other than Sinclair Oil Corp., took no part in the hearing. Sinclair said a need exists for controls—including residual—but criticized allocation methods.

Government attitude. The disquieting note, for producers, at the hearing was the evident lack of enthusiasm for oil controls on the part of several spokesmen from several government departments.

A State Department official warned of problems that "too much" government intervention could cause, and tended to minimize the danger of U. S. dependency on foreign oil sources.

A Defense Department witness said that while the military ranks domestic oil sources first in importance and Western Hemisphere sources second, it also would like to have oil available at points throughout the world. He also mentioned the added cost of petroleum purchasing because of limitations on the military's purchases abroad.

A Commerce Department official spoke of the over-all need for encouraging a greater flow of goods and indicated that Commerce does not favor any further tightening of restrictions.

All in all, the feeling many observers got was that the administration is likely to be extremely reluctant to impose tighter oil-import controls and might even consider easing them as a part of its over-all international trade liberalization policy.

Residual fuel. Views on residual-fuel-oil-import controls were even more widely divided at the hearing than those on crude-oil restrictions.

The coal industry said that even tighter controls are needed as a national security measure to prepare the coal industry to meet emergency needs and to lessen the East Coast's dependency on foreign sources of residual.

IPAA and TIPRO also supported continuation of residual controls, principally because they feel any exceptions to the control program tend to weaken the structure so that crude oil controls, too, would be adversely affected.

Furthermore, they said, an increase in the flow of residual fuel would tend to reduce domestic refinery margins and thereby lead to a downward pressure on domestic-crude-oil prices.

Industrial representatives from New England and the Independent Fuel Oil Marketers Association took exactly the opposite view. They said controls are unnecessary and only serve to force fuel prices up and to distort normal distribution patterns.

NPC to study impact of soviet exports

A STUDY on how the free world is affected by exports of petroleum from the soviet bloc will be made by the National Petroleum Council.

The Department of Interior asked NPC last week to undertake such a study and the council immediately accepted the assignment.

J. Ed Warren, president of Cities Service, will be chairman of the committee.

Indications were that the study would be started immediately and that a vigorous attempt would be made to prepare a report as quickly as possible.

John M. Kelly, assistant secretary of Interior who also serves as the government cochairman of NPC, says the report will be used by Interior in its analysis of the increasing problem of soviet oil expansion into free-world markets.

Walter S. Hallanan, NPC chairman, termed the assignment the most important action taken at last week's meeting of the council.

In addition to asking for a factual study, Interior requested NPC to submit its comments and conclusions on the problem of soviet oil penetration.

The American Petroleum Institute will delay release of its policy statement on the threat of Russian oil, now that the Government has invited the NPC to make a review. API officials were plainly pleased at the concrete expression of government concern.

Petrochemical data sought

. . . from oil, gas companies by NPC committee. Information will be available to defense-planning agencies.

A QUESTIONNAIRE requesting detailed data on chemical-manufacturing facilities was mailed to oil and gas companies last week by a National Petroleum Council committee.

The questionnaire has been sent to 285 firms and 183 natural-gasoline groups. The list of 285 includes 15 chemical companies in which oil and gas firms own more than 50%.

The questionnaire covers 86 chemicals manufactured by oil and gas companies, and calls for such information as the firm's capacity for each chemical as of last January 1, new capacity scheduled by July 1, 1963, and actual production for the year 1960.

In a letter accompanying the questionnaire, it is stressed that the information will be kept strictly confidential, except that it will be available to governmental defense agencies for use in classified studies. Only industry-group totals will appear in the final report of the committee, and even this will not be done if a chemical is manufactured by less than 3 producers.

The over-all study is being made by the NPC committee on petrochemicals. A technical subcommittee is in charge of collecting the plant-by-plant data.

A member of the committee says the study, being made at the request of the Department of Interior, does not include oil-line chemical companies because those are not within Interior's defense-planning jurisdiction. However, he adds Department of Commerce officials have indicated they hope to conduct a similar study of chemical companies.

Oil tries hard sell in employe-information

Oil needs employe backing to win broad public support on critical issues. With that in mind, API is directing a hard-hitting campaign to give workers a better understanding of industry and individual-company problems.

Gene T. Kinney
East Coast Editor

MOST oil-company employes have probably observed a marked change in the editorial diet being served up in their company publications.

Gone now, or at least relegated to the background, are the features aimed at industry image building. These stories recited the epic of the industry's progress, of its romance, of how essential it is to the economic life and security of the nation.

In their place there is plain talk about profits and politics; discussions of industry and individual company problems with a candor that would have occasioned much eyebrow lifting in another day.

"We've stopped feeding them pablum," says the employe relations director of one company, "and have switched them to solid foods."

Oil's No. 1 public. Behind the rather drastic change is a startling discovery, or rather a rediscovery, of a fact once known by most but forgotten by many:

On critical public issues affecting oil, a large segment of industry personnel is only slightly more informed than the public at large. And the situation which finds an oil-company employe ill equipped to explain the niceties of the basis for percentage depletion is not entirely his fault.

As part of an industry reappraisal of public-relations efforts, one conclusion was that oil companies, in their zeal to win public support on vital issues, had slighted their No. 1 public—their own employes. If service station dealers are included, this potential audience amounts to 1½ million.

Without employe understanding and backing, it was reasoned, any attempt to win broad public support would achieve limited success at best.

API program. The American Petroleum Institute employe-information program was originated in 1953 as a part of the Oil Industry Information Committee.

Until 1958, this group concerned itself mainly with long-range, noncritical subjects. It produced leaflets on important issues such as depletion, taxes, prices, and competition, but the materials indicated the industry was not yet ready to accept the broad-gage, hard-hitting campaign in progress today.

The new direction for this effort can be traced to the creation of the Committee on Public Affairs, successor to the OIIC, in 1958. Kerryn King, assistant to the chairman of Texaco Inc., was the first CPA chairman. The committee is now headed by W. F. Kenney, Shell vice president and general counsel.

When CPA was formed, it established a new Advisory Committee on Employe Information, including communications specialists from large and small companies. The committee, now headed by J. Harve

Here's what API is doing

API'S Committee on Public Affairs tackled the employe-information problem soon after it was created 3 years ago.

It has already prepared straight-talk information packages on the cost-price squeeze, gasoline prices and taxes, and percentage depletion.

Next year there will be another package on depletion, prices, and profits. The gasoline-price and cost-price squeeze packages will be updated.

The material appeals to the employe's intelligence as well as his pocket-book interest. It is not served up as predigested opinions of management.

CPA's major goal next year will be to get more companies to take part in the program.

The shape of things to come?

program

Washington of Continental Oil Co., recommends broad policy to CPA. It also assists and guides the CPA staff in developing materials which companies may use as is or in modified form in their internal communications programs.

CPA, in examining the means of achieving public support for views endorsed by the oil industry, assigned a high priority to informing the industry's own employes and encouraging them to speak up on critical issues. The committee further decided to hit a few big issues and ignore others.

Campaigns were ordered on gasoline taxes, percentage depletion, gasoline prices, and the cost-price squeeze. An information package on each subject offers an across-the-board program including leaflets, posters, background material from which a company can develop its own materials, finished articles, and speeches.

The new look. This specific-issues approach has been adopted by many companies during the past 2 years, and a few were conducting similar programs earlier.

Here is a sample from a company's cost-price squeeze material:

"It (the cost-price squeeze) affects you because your future success and earning power depend on your company's own success, its ability to earn a profit and to apply that profit to the continuing hunt for oil it needs to stay in business.

"Therefore, you—as an employe—have a personal stake in helping to cope with this cost-price squeeze. Anything you can do to keep costs in line, to eliminate waste and promote efficiency will improve your company's ability to deal with these difficult economic problems."

When honed to a razor's edge for individual company use, this material can become a blunt statement of the competitive facts of life. The following excerpt from the 1960 annual report to Shell employes by M. E. Spaght, president, is a prime example:

"Shell is a sound, growing company, but there are clear demands on each of us if it is to remain so . . . One of the first is avoidance of waste. Waste, it seems to me, is the failure to make proper use of our time, energy, skill, knowledge, materials, and equipment—and probably the most serious of these is waste of time . . ."

Fifty oil companies—including all majors—have assigned headquarters contacts to carry out the API program. However, response thus far is rather spotty. Some companies have no organization to conduct such a program. Therefore a major 1962 goal of CPA will be to gain management understanding and support of its efforts.

An indication of the expansion of the program can be seen in the rapidly growing participation in annual employe communications conferences at which new material is unveiled. Regional meetings are scheduled for New York on January 9, Chicago on January 24, New Orleans on February 9, Dallas on February 27, and Los Angeles on March 8-9.

Company action. Some companies have done outstanding jobs either in using the API packages, in adapting them to their purposes, or in creation of entirely new materials. Examples are:

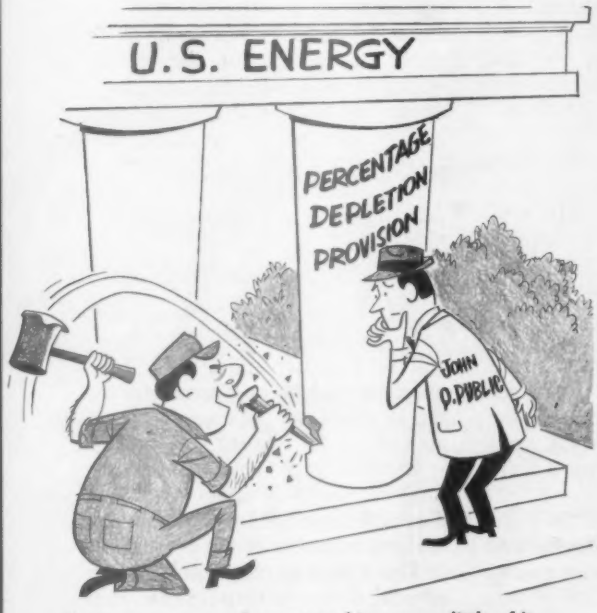
Sun Oil Co., on gasoline taxes.

Gulf Oil Corp., on depletion.

Standard Oil Co. (Ohio), on gasoline prices.

So elaborate has Sun's campaign been that the company's name has become synonymous with a crusade to inform the public—including its employes—on gasoline taxes.

Sun was a leader in the petition



Don't worry—we only want to chip away a little of it.

Editorial excellence:

Journal wins award for "smog" report

THE Oil and Gas Journal has won the coveted 1961 Industrial Marketing Award of Merit for its 12-page report on "How Refiners Are Combating Air Pollution."

The award was "for editorial excellence" in original research on a subject of major importance to the industry.

The winning article appeared in the Journal's February 20, 1961, issue. It was written by D. H. Stormont, refining editor, who analyzed such factors as cost, type of equipment used at refineries, relative payout, sources of pollutants, complaints against refiners, and automobile exhaust.

The report met immediate success. The industry and state departments of public health requested thousands of reprints.

The Journal's entry was one of many in IM's Twenty-third Annual Business Paper Editorial Achievement Competition.

campaign urging congressmen not to extend the temporary 1-cent levy which was to have expired June 30, 1961. If the campaign had been successful the tax would have dropped to 3 cents a gallon. Significantly, Robert G. Dunlop, president of Sun, was active in the campaign.

Numerous articles in Sun publications and other media were used to inform employes, stockholders, and outside groups on the facts of gasoline taxes and their diversion to nonhighway uses.

Although the "temporary" tax did not expire, Sun considers its efforts far from fruitless. "It has given employes a basic understanding of the tax issue and its importance to the company, which will serve as a foundation for future communication efforts on this subject," Sun reports.

Gulf's top management decided in 1958 to conduct an all-out effort to counter growing opposition in Congress and in the press to percentage depletion. It was aimed at employes as well as persons outside the industry.

In the past 2½ years, an audio-visual show, including a color film, slide presentation, and a film statement from W. K. Whiteford, chairman of Gulf, has spread the depletion message to more than 22,000 company employes and others in 34 states. Gulf also mailed almost 400,000 pieces of printed material to persons inside and outside the industry. Its audio-visual presentation has been made available to other companies at cost.

Sohio embarked on its gasoline-price campaign last August with an announcement by Charles E. Spahr, its president. Some 10,000 employes received leaflets on "The Case of Similar Gasoline Prices," "The Case of Uniform Gasoline Prices," and "The Case of Different Gasoline Prices." They were sent also to 40,000 stockholders.

One of the leaflets will be mailed to 500,000 billing customers. In addition, 10 visual presentation kits on gasoline pricing have already been sent to operating centers. These will be used at employe meetings.

Model program. One of the strongest boosters of the API program is Shell Oil Co.

Shell published its first house organ more than 40 years ago, and has been a pioneer in employe information.

"There is a constant struggle centered around whether it is proper to withhold or give information," a Shell spokesman explains. "For every time it is proper to withhold information, there are 50 times when it is beneficial to give it."

Shell has a master plan for the entire year encompassing all media — monthly magazine, management letter published as needed, 27 local newspapers in large plants and division locations, a news service, special booklets, a new film every 2 or 3 years, and 800 bulletin boards that are changed weekly.

Shell likes the API packages because they take all media into consideration and fit into a planned approach for the year. "The API program focuses on problems common to all of the industry," the company explains. "It is a program that everyone can sink their teeth into. The pity is that so many people don't realize what they have and are not organized to use it."

Kansas finally raises crude allowable

KANSAS crude-production allowable for December has been increased 2,500 bbl. daily, the first boost in 7 months. The month's total allowable will be 302,500 bbl. daily.

The higher allowable will permit wells on 80-acre spacing to produce an extra 25 bbl. daily over their current allowables. It also will permit continuation of special depth allowables and allocations for fields under special orders.

The Class B and C areas, the prorated and restricted fields, will continue under a 25-bbl. daily per well maximum allowable, and the unprorated Class D fields will keep their 25-bbl. top figured on a lease basis.

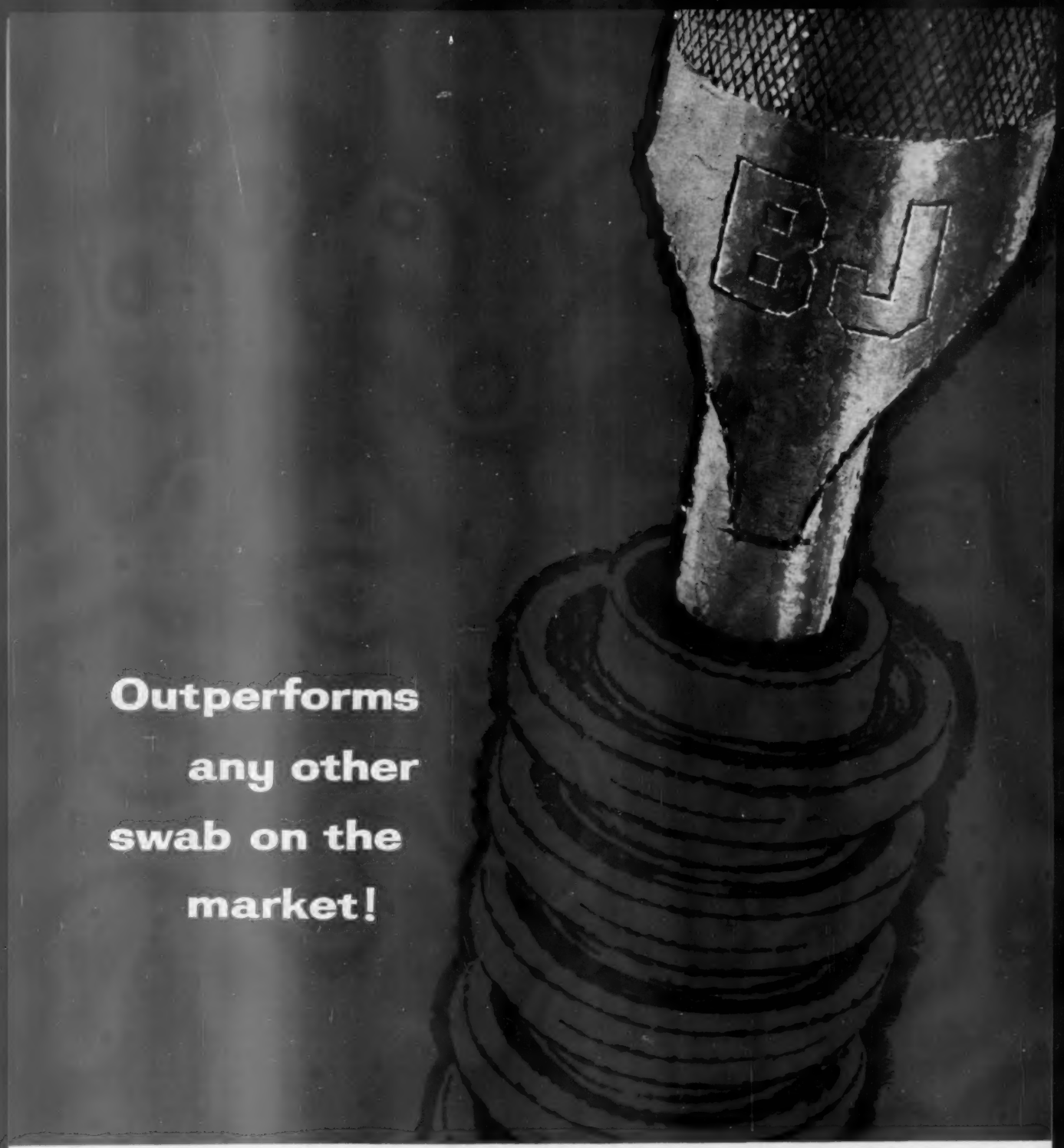
The allowable ruling of the Kansas Corporation Commission was taken in the face of conflicting market data. The Bureau of Mines forecast of demand for Kansas crude in December was 315,000 bbl. daily, an increase of 5,000 bbl. from November. Nominations by crude oil buyers for the month, however, totaled 299,012 bbl. daily, down 1,192 bbl. daily.

New gas-treating process to be used in West Canada plant

THE PETROGAS Processing, Ltd., plant being built at Calgary will be the first major natural-gas processing plant in Canada to use the Benfield hot-potassium carbonate process for treating sour gas.

Humphreys & Glasgow (Canada), Ltd., recently was appointed Canadian representative for Benson, Field & Epes, licensers of the process.

The Calgary plant, which is scheduled for completion next month, is designed to treat 150,000 M.c.f.d.



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What Skelly expects from decentralized

Skelly hopes to gain a competitive edge by moving decision making closer to the service station. Top executives have more time for long-range planning. Another Skelly marketing approach: selective growth.

W. A. Bachman
Marketing Editor

SKELLY Oil Co. is decentralizing its marketing organization as part of a move to put more muscle into its sales effort.

And Marketing Vice President Paul Tanner admits plenty of muscle will be needed if Skelly or any other company is to stay alive and grow in the highly competitive region stretching from Canada to Texas.

Decentralization, however, is only one of several moves planned by Tanner and his staff aimed at putting Skelly up front in the next few years.

Skelly completed the mechanics of decentralization this fall. It regrouped its former divisions into three regions with headquarters at St. Paul, Minn., Des Moines, Iowa, and Kansas City, Mo. It shifted or reassigned its manpower into three well-organized field forces.

Tanner and his headquarters staff at Kansas City admit they undoubtedly still have some bugs to work out of the decentralized setup. Their aim at going this route, however, was to:

Move decision making closer to the customer for speed in meeting competition and for better service.

Free the home office from many routine supervisory chores for broader planning work and policy decisions.

Give a group of younger Skelly executives a better chance to grow and develop.

How it works. Each Skelly region is a complete marketing company within itself.

The regional manager has an administrative assistant to direct housekeeping, paper work, accounting, and finances. He has sales managers for petroleum and Skelgas, a manager for operations and engineering, a credit manager, and an attorney.

Each sales manager has under his direction special supervisors and district sales managers. The regional operations and engineering manager also has supervisors for real estate, construction and equipment, warehousing, and automotive transport.

The home office maintains communications and control with the regions through the general manager for marketing, V. H. Gibson. Regional managers report to him.

Gibson also directs the work of the home office supervisors for petroleum sales, Skelgas sales, special sales and services, operations and engineering, and credit. These supervisors have contact with their regional counterparts.

Other members of the headquarters team who report direct to Vice President Tanner are the marketing counsel, the director of research and planning, and advertising director.

Tanner and the home-office staff have given the regional offices the authority and the manpower to operate on their own with only a minimum of direction from Kansas City. Tanner believes this is important in orienting the business closer to particular needs of the consumer in each area.

Tanner said the regional staffs were handpicked to provide a balance between young men and veterans. This gives the younger men a chance to gain sales and management experience as well as profit from the experience of the veterans. This manpower policy is backed up by a plan of carefully screening new sales employes and then giving them thorough training.

Skelly also has set up what Tanner claims is one of the best and most intensive dealer-training programs in the industry. The prospective dealers are introduced to all phases of the industry and then are exposed to classroom work and actual driveway work in the many aspects of running a service station.

Tanner's aim is to have a top-grade, well-trained force from the service station driveway to top mar-

Skelly's new marketing regions . . . . . and the top policy makers

Paul A. Tanner
Marketing vice president

V. H. Gibson
General manager, marketing

keting management. He feels this is necessary to support Skelly's plans for the future.

Expansion ahead. The big job now for the Skelly home-office staff is planning for growth.

Tanner is following a plan of selected expansion backed up by research. Careful surveys are made for each new service-station location, and an economic analysis of the area determines the type of operation followed.

Thus far the bulk of the year's new locations has been in growing suburban areas, near shopping centers, or in residential areas with good volume potential.

This careful selection is necessary because Skelly constructs expensive, full-facility stations of porcelainized steel walls. Their ease of maintenance partially offsets the initial cost. Nonetheless, the over-all investment involved in each station demands a good location with high-volume potential.

Tanner said Skelly also is expanding into the truck stop business and has plans to become a major operator in this phase of marketing. The company has built or helped its jobbers construct many new 24-hour truck stops this year, all located in the Middle West. A number of other truck stops have been upgraded.

Others will be built in the months ahead on strategic rural locations at convenient stop points from terminal centers. These units offer comfortable, air-conditioned rooms for sleeping, a good cafe, and a complete line of fuels and service for the big highway transports.

One favorable aspect of the truck-stop operation is a credit-card tie-in with Pure Oil Co. with similar operations in the Southeast and with Tidewater in the West to give truckers a line of good truck stops across the continent.

Skelly constantly is trying to strengthen its position by adding new jobbers and to expand by purchasing going marketing concerns. At the moment, plans call for keeping this growth close to the company's present refining and distribution system.

WATCHING WASHINGTON

with Clyde La Motte

U. S. Government looks for ways to cope with soviet oil

GOVERNMENT officials are becoming acutely aware of the importance of the soviet oil threat.

Note these developments last week:

Interior asked the National Petroleum Council to make an immediate study of the impact of soviet oil exports on the free world.

A Commerce Department official suggested to a House (Steed) subcommittee that it might well look into the possibilities of an international oil agreement aimed at combating the soviet oil thrust.

A State Department official indicated that State is involved in several areas where soviet oil deals threaten to cause a nation to become dependent on Russia as its oil source.

And at the mid-November API meeting in Chicago, Sen. A. S. (Mike) Monroney (D.-Okla.) said bluntly that Russia's economic war on the West will be won or lost by the success or failure of its oil-export program. Monroney urged a government-industry "partnership" to counter this threat.

Others, including industry spokesmen, also have been underlining the urgency of the Russian move.

It adds up to this: the Government's thinking and its policies will be colored by the consideration given to soviet oil maneuvers. And the industry will be drawn into the picture increasingly.

Producers are pessimistic over delay in new program

LATEST word on revision of the oil-import-control program: the State Department has been asked to supply the White House with some further information. Presumably on the possible impact that might be created abroad by any further cut in imports.

Producer representatives in Washington are glum. They figure the delay in a decision on Interior's proposals simply means a watering down of the program. Some of the more pessimistic now fear that present controls may even be loosened instead of made tighter.

FPC spells out its intent on "pipeline-quality" gas

THE Federal Power Commission has put a new light on its plan to establish standards for "pipeline-quality" gas.

It has called for industry comment by December 20 on whether variations might be justified for a particular area under certain conditions.

The FPC said its announcement last May of a proposed rule had apparently been interpreted by the industry as meaning that the FPC intended to adopt a single nationwide standard.

Not so, the FPC said last week in calling for further industry comment. Specifically, the agency wants comment on the proposed "sweet-gas" standard and price deviations from it for "sour" gas, including costs of treatment.

Comment was also invited on the proposed delivery-pressure standard and price deviations from it, including compressing costs.

In earlier comments on the proposed rule, the industry objected strenuously.

"Met-X" unit going on stream

FIRST commercial application of a process for removing metal contaminants from cracking catalyst is undergoing its shakedown run at the Philadelphia refinery of Atlantic Refining Co.

Preliminary results indicate an annual saving of at least $1,000,000. This will accrue both from lower catalyst consumption and higher yields of high-purity products from the two cat units which have a combined capacity of 48,000 bbl. daily.

The Atlantic-developed process—called Met-X—continuously recieves a slipstream of contaminated catalyst from the crackers. After passing through the purification process, catalyst is returned with its original activity restored. Capacity of the plant, shown in photo, is 40 tons of catalyst daily.

In addition to lowering the costs of catalytic cracking for such stocks as heavy gas oils, the new process may prove to be a useful tool for cat cracking reduced crudes.

All details so far released by Atlantic on the Met-X process will appear in an article in the December 11 issue of the Journal. A story on pilot-plant tests appeared in the October 9 issue.

Crude runs jump again after coastal refiners step up their activity

COASTAL refiners have kicked up runs substantially to push the national throughput above the 8.3-million barrels daily mark for the week ended November 24.

The Texas Gulf Coast district accounted for more than half of the 131,000-bbl. daily boost over the previous week. Crude runs in this area averaged 1,904,000 bbl. daily, a gain of 87,000 bbl. daily over a week earlier and 28,000 bbl. daily over the same week last year.

Runs at inland refineries, meanwhile, were reduced by 48,000 bbl. daily for the week and 23,000 bbl. daily from last year's average.

Result of the increased runs was a gain in production of gasoline, kerosine, and residual fuel. Production of distillate declined 63,000 bbl. daily from the previous week.

Refinery runs
(Thousands bbl. daily)

		Change from	
	11-24-61	11-17-61	11-25-60
East Coast	1,104	26	60
Texas Gulf Coast	1,904	87	28
La. Gulf Coast	729	12	68
West Coast	1,295	54	80
Total U. S.	8,303	131	211

Fluor awarded big contract for Kyso's Pascagoula refinery

A MAJOR contract covering part of the units going into the projected Standard Oil Co. (Ky.) refinery at Pascagoula, Miss., has been awarded to Fluor Corp.

The Fluor contract covers the 100,000-bbl. crude-distillation unit plus the Isocracking plant. The Isocracking plant will include an 18,000-bbl. Isocracking unit, a 32,000-bbl. catalytic reformer, a 19,000,000-cu.-ft. hydrogen plant, and a boiler plant.

Chicago Bridge & Iron Corp. has been awarded the contract to provide for 7,000,000 bbl. of storage.

Other work. Some other contracts remain to be let for the new facility.

Among other units planned in the refinery are a 45,000-bbl. catalytic cracking unit and an alkylation plant. The cat cracker will have a fresh-feed capacity of 22,500 bbl. daily and a 100% recycle capacity.

Some pipeline contracts also are to be let.

The refinery is scheduled for completion in mid-1963.

H-oil process bowing in

THE FIRST hydrocracking plant to upgrade sour residual oil into the equivalent of a middle-gravity, sweet crude will be built at the Lake Charles, La., refinery of Cities Service Refining Corp.

Hydrocarbon Research, Inc., has the contract for the design, engineering, and construction of the 2,500-bbl. daily unit, scheduled for completion in the fall of 1962. This will be the first plant to use the H-oil process.

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Incentive gas pricing—5

Gas is not paying its own way, producers

Gas has come into its own and no longer is a by-product of oil exploration. Present wellhead prices are too low to pay costs of finding and developing new reserves. Unless prices go up, producers will quit looking for gas.

Henry Ralph
Chief Editorial Writer

THE BIGGEST stumbling block in all attempts of the Federal Power Commission to regulate gas prices is the problem of allocating joint costs of exploration and development between oil and gas.

In the Permian basin area-pricing hearings the producers offer a solution to this. They agree with FPC's conclusion in its Phillips opinion that any mathematical formula would be arbitrary and unsatisfactory. So they show a way to get around the obstacle by analyzing industry-wide cost trends to give FPC the data it needs to determine the "reasonable financial requirements" of the industry.

They do this by studying the "entity" of the industry which gives the closest possible picture of what the producing business would be like if it were hunting for gas alone. They show that the industry can and does segregate, as between oil and gas, the major elements of development costs, determine the incentive price needed for either one, and enlarge or contract its gas-exploration activity depending upon the price of gas.

Admittedly this is not "cost allocation" in the technical sense of public-utility accounting, but it is a cost apportionment of sufficient accuracy to have a tremendously potent effect on the producing industry and therefore, it is agreed, it should be acceptable to FPC.

The demonstration emphasizes two main points:

The cost-price squeeze. Costs of exploration, drilling, and production have been going up much faster than the producing industry's income from wellhead sales of both oil and gas, with the result that many producers are in a financial pinch and are cutting expenditures by curtailing exploration.

THIS concludes the five-part series of articles analyzing the producers' case for incentive gas pricing. This article and the earlier ones (OGJ, Oct. 30, Nov. 6, Nov. 20, Nov. 27) are based on testimony at the recent FPC Permian basin area-price hearing.

The tail wags the dog. The hunt for gas rather than oil is taking an increasingly larger share of the industry's exploration budget; the cost of developing new gas reserves is increasing rapidly in relation to the cost of new oil reserves; but gas is not paying its proportionate share of wellhead revenue.

Detailed statistical evidence supporting these conclusions was presented at the Permian-basin hearings by several producer witnesses, but the witness dealing most specifically with the division of costs was R. M. Brackbill, manager of economic analysis for Shell Oil Co.

He said his studies eliminate the accounting problem of joint-cost allocation by analyzing the physical factors—related directly to gas-producing activities—which can be translated into expenditures and unit costs. His analysis demonstrated that expenditures for gas supplies are increasing at a greater rate than the revenue derived from gas production.

The old bugaboo—once believed by producers themselves—that exploration is for hydrocarbons and that only chance determines whether a discovery will be oil or gas was laid to rest by several producer witnesses. To a rapidly increasing degree, producers can and do channel their exploratory campaigns toward regions where the geology offers decidedly more probability of the occurrence of gas than of oil—provided the gas price there is commensurate with the anticipated costs of finding and producing gas.

The most specific example of this was the revealing experiment of Phillips Petroleum Co., which has already been rather widely publicized (for example, see OGJ, Oct. 30, page 102).

1. Gas hunt risky

Closely related to cost allocation is a second major problem—segregating the financial structure of the producing branch of the industry from other phases of the oil and gas business. Many analysts have used financial reports of major integrated companies to show, for example, that the oil business is no more risky than others, or has no special financing problems, or needs no higher rate of return than the average industry.

This problem, too, was surmounted by one of the producers' witnesses: John R. Scott, vice president of Republic National Bank of Dallas. Scott analyzed the financial structure of the industry to pull out what he said was a sample very much representative of the exploration and production segments of the industry.

Oil and gas production, Scott demonstrated, is a "low-debt" industry, in that the average producer's capital structure is approximately 88% equity capital and only about 12% long-term debt. This is commensurate with the degree of risk, and contrasts with the "high-debt" utility industry where equity capital is very small in relation to long-term debt.

Banks and other usual sources of funds won't lend money for wild-

tell FPC

catting, Scott explained. So producers must finance exploration with their own money or with equity investments from individuals willing to take a big gamble.

Moreover, the debt ratio is declining among producers, due to the "tight money" market and the devaluation of assets caused by the lower income from oil production and reduced exploration in recent years. Producers refinancing bank loans find that, because of lower oil allowables and crude prices, their producing properties have less value.

"Ten years ago," Scott said, "about 75% of the loans made by the oil and gas department of Republic National Bank were loans to finance expanding production. They were loans which both developed reserves and which freed funds to expand the reserves by further exploration.

"Today 80 to 90% of the loans made by my department are loans to buy established production—reserves already developed, drilled, and producing. They are loans for financing the purchase of producing properties sold by producers who cannot or are not willing to continue shouldering the risks of exploration, development, and production, or have found themselves in a precarious financial condition.

"While it is true that most of the larger companies are not selling off their production, one look at the downward trend in exploration shows that producers are not channeling funds into exploration. They do not seem to think that the rewards justify the risks involved.

"Declining revenues from the sale of oil and gas will probably force some companies that have not been there before to attempt to enter the debt-capital market. In many cases, the demand will be for funds from debt financing to replace the funds no longer being provided because of dwindling cash flows.

"Unfortunately, this type of borrowing generally will not be for the expansion of the industry but rather for the purpose of maintaining current levels of production for the companies concerned by acquisition of producing properties.

"When managers increase the risks of their capital structure by increasing debt financing, they usually compensate by cutting back the risks of their operations. The easiest and most effective way to cut back is to reduce exploration.

"The major source of funds for the oil and gas industry in the past has been cash earnings retained in the business. If there is to be an expansion of the industry it will have to be financed from this same source," Scott testified at the hearing.

"If oil revenues are not going to be able to supply the necessary funds to increase exploration and production activities, then the revenue will have to come from the sale of gas. In the past, gas revenues have not been an important source of funds for the industry. As the demand for gas continues to increase, it is becoming clear that this situation will have to change.

"Gas is going to have to provide to the industry enough cash earnings to finance finding and developing the largest portion of any expanded requirements for gas, or the

New gas facts presented at Permian basin meeting

HERE are some of the facts presented to the FPC in support of the producers' case for higher natural-gas prices:

AVERAGE cost per foot for drilling gas wells is $18.45, compared with $13.63 for oil wells.

•

GAS WELLS account for 27.8% of industry drilling expenditures for productive wells.

Producers drilling more and deeper gas wells

	% increase wells drilled (1950-1960)	% increase footage (1950-1960)	% increase avg. depth (1950-1960)
Oil	—6.5	—6.7	—0.2
Gas*	47.4	106.1	39.8
Dry	21.9	51.7	24.5
Total all wells	8.0	22.1	...

Note: Figures exclude service wells. *Includes condensate wells.

•

EXPLORATORY expenditures per field discovered totaled $1,877,000 in 1950 and $2,958,000 in 1958.

•

PRODUCERS' gross investment per well was $25,000 in 1950 and $46,000 in 1960—an increase of 89%. But revenue per well increased only 32%—from $8,604 to $11,361.

•

Costs are rising six times faster than income

All hydrocarbons—	Cts. per million B.t.u. in 1950	Cts. per million B.t.u. in 1960	% increase	Avg. % increase per year
Expenditures for reserves added	9.0	15.7	74.4	5.7
Investment remaining in previously found reserves	2.22	4.01	80.6	6.0
Revenue per unit produced	29.52	32.40	9.8	1.0

requirements will not be met," Scott said.

2. Learned's summary

Then came the clincher, the closing witness who put meaning to the hundreds of pages of statistics that had been introduced before. He was Stanley Learned, chairman of the executive committee of Phillips Petroleum Co.

Speaking from the standpoint of management, Learned declared that regardless of what sort of formulas and statistics the accountants and economists come up with, the thing that determines how much gas is going to be found and produced is the judgment of the managements of thousands of individual producing companies as to whether or not the price of gas is going to be worth the effort of supplying it.

Learned made three points:

1. When a producer is caught in a cost-price squeeze he can control many of his expenses, and the first one to be curtailed is expenditure for exploration.

2. It is possible to direct the major portion of exploration expenditures toward or away from prospects most likely to yield gas rather than oil.

3. Exploration funds must be generated from earnings of producers, and the funds generated by gas sales must be sufficient to cover the costs of developing gas reserves or else producers simply won't find much gas.

When a producer curtails exploration, Learned explained, he is simply selling off his inventory and undergoing a process of liquidation, though at the same time his operations may show a book profit.

The fact that Phillips has been able to segregate the gas-hunting part of its exploration program with such surprising accuracy that last year more than 80% of all its exploratory expenditures were directly anticipated to have been made for gas, is an indication that today the search for gas is more attractive than the search for oil, Learned admitted.

"However," he added, "I certainly do not believe that exploration for either oil or gas in this country is now especially attractive. In my opinion, if the industry is to be expected to find supplies of gas adequate to meet the increasing demand for gas in this country, the incentive offered by price must be more attractive than it now is.

"Funds to expand the exploratory effort must come from present revenues—and the incentive to make such expenditures must be provided by prospects of future income. A mere promise of incentive prices in future sales, coupled with a holding down of present prices below existing contract terms, will not get the gas supply required to meet consumer demand" in the future.

"It is clear to me that the adequacy of exploratory effort for, and the ultimate finding of, future gas supplies will depend upon the existence in the industry of the following three factors:

First, the producer must be able to anticipate gas prices which will give him an incentive to hunt for gas.

"Second, the producer must have adequate funds for exploration, and these funds can come only from existing gas sales.

"Third, the producer must have confidence of the continuation of these first two factors.

"In other words, the only confidence the producer can have in future adequate pricing must be based on the treatment he is accorded on present gas sales. The treatment to date does not instill that confidence.

"Regardless of how the commission goes about setting price levels—whether by cost or otherwise—only prices which will be adequate incentives to get thousands of producers to search for more gas will bring us an adequate supply."

That is the epitome of the "incentive price" approach to gas regulation, the foundation for which had been laid by a dozen preceding witnesses in what is perhaps the most thoroughgoing economic analysis of the gas-producing industry that has ever been made.

Industry briefs

Proposed sale of Western Leaseholds, Ltd., Calgary, to Canadian Fina Oil, Ltd., has been announced. Canadian Petrofina, Ltd., owns all of Canadian Fina and a majority of Western's stock. Under the plan, Western's minority stockholders would receive $6.46 a share. Canadian Petrofina would receive a lesser amount for its Western stock. The deal is expected to be completed next January.

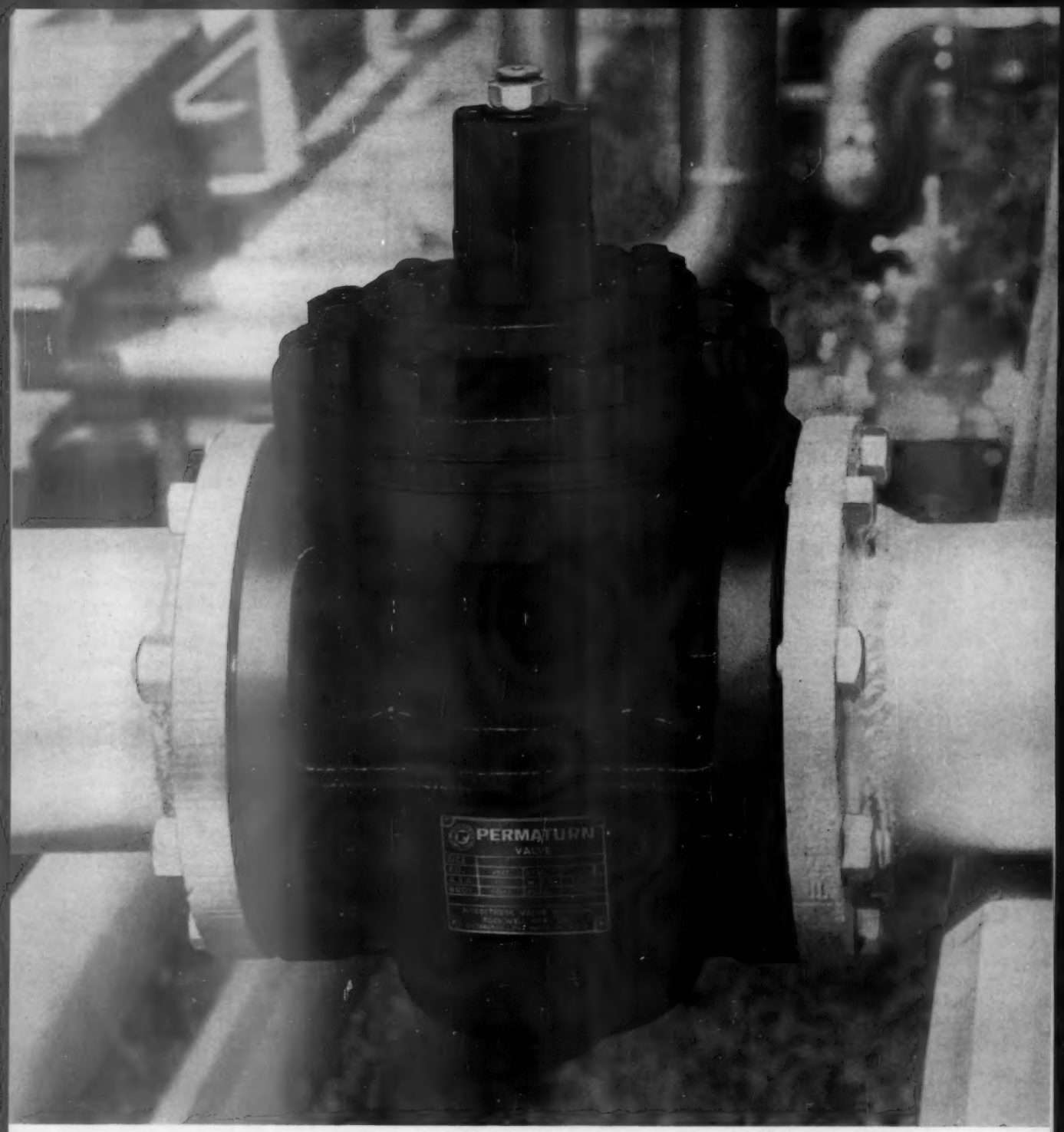
Acquisition of 18 oil and gas wells in Texas and Canada has been completed by United Australian Oil, Inc., Dallas. The properties were obtained from Nortex Oil & Gas Co. and Landa Oil Co., both of Dallas. The 18 wells include 10 in Benson and Gainesborough fields in Saskatchewan; three in West Taft field; two in Santa Ana field; and single wells in Hildreth, Fullerton, and Wasson fields in Texas. United Australian says production income will be used in exploring and drilling its extensive concessions in Australia.

Offers to buy Parcel 903, which included underwater acreage, have been rejected by Alberta's Department of Mines and Minerals. No reason was given. Part of the parcel was in Buffalo Lake. It was the first drilling reservation the province has offered which included underwater acreage (OGJ, Nov. 27, p. 69).

American buyers of Canadian crude were pleased last week to see Canadian dollar fall to 95.88 cents U. S., a 10-year low. This meant a further price advantage with respect to U. S. crude. The Canadian Government has driven down the exchange value to spur exports and to discourage imports of all commodities.

Two Florida marketing firms—Eveland Oil Co. and Hurricane Oil Co., both of Orlando—are being acquired by Plymouth Oil Co. Involved are 12 service stations and a bulk plant. Plymouth will supply the outlets with gasoline from its Texas City, Tex., refinery. Plymouth itself is reportedly up for sale.

A special election will be held February 27 in Long Beach, Calif., to decide whether the tidelands portion of Wilmington field will be opened for leasing (OGJ, Nov. 20, p. 140).



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Cities Service reserves top 800,000,000 bbl.

PROVED reserves of crude oil, condensate, and natural-gas liquids of Cities Service Co. in the U. S. and Canada are estimated by the company at 800 million barrels.

The reserves, as of the end of 1960, were disclosed in a proxy statement issued for a special stockholders meeting called for December 20 to pass on the acquisition of Columbian Carbon Co. The "pooling of assets" would be effective January 31.

Cities Service estimated it owned natural-gas reserves of 8.3 trillion cubic feet. An additional 7.1 trillion cubic feet are controlled under gas-purchase contracts.

Domestic and Canadian proved reserves of crude oil and condensate held by Columbian Carbon at the end of 1960 were estimated at 18 million barrels. The company has 26 million barrels of natural-gas liquids reserves in the United States.

Fairway field ruling held up

Texas Railroad Commission postpones action on request for allocation formula based 100% on acreage.

THE Texas Railroad Commission has put off until next February any decision on whether to change the allocation formula for giant Fairway oil field in East Texas.

Oil production in the James lime field now is allocated under a temporary formula based 50% on acreage and 50% on the number of wells in the reservoir. Atlantic Refining Co., supported by a large majority of other acreage holders in the field, recently asked the commission to adopt a permanent formula based 100% on acreage.

Such action was opposed by owners of small-tract leases within the townsite of Frankston, which overlies part of the field's Anderson County area.

The Atlantic application was made well in advance of a hearing in February which will be held to adopt permanent field rules as a matter of routine. The commission now has deferred action on the application.

One of the motives of Atlantic and other operators in seeking earlier action was reportedly to head off drilling on the small-tract leases in Fairway.

An Atlantic spokesman told the Journal last week, however, that he feels the delay itself may serve as a deterrent to anyone thinking of drilling on town-lot leases.

Quitman first oil case? The Fairway case had been regarded as the first test of how the Texas Supreme Court's famous decision in Normanna gas field (OGJ, Mar. 13, p. 100) might affect commission proration of oil fields with small-tract problems.

It now appears that the "guinea-pig" oil field may be Southeast Quitman multipay pool in Wood County.

A commission hearing is scheduled today to set or review formulas in four Southeast Quitman reservoirs in the light of "certain decisions by the Supreme Court."

Processing briefs

New pipestill capable of processing 150,000 bbl. of crude daily—world's largest—is now on stream at American Oil Co.'s Texas City refinery. This is part of a multimillion-dollar modernization program which includes huge alkylation and isomerization units previously completed and a catalytic cracking unit scheduled for completion in January.

Propylene oxide facilities will be installed at Wyandotte Chemicals Corp.'s chemical complex at Wyandotte, Mich. Fluor-Singmaster & Breyer, Inc., has the contract to design, procure and construct the unit with completion scheduled for July.

A small refiners group to be known as the American Petroleum Refiners Association is being set up to supplement efforts of other refiner groups. The organizers want to bring together companies whose capacity is around 10,000 bbl. daily and who have problems in common not shared by the larger companies. One duty of APRA will be to appeal to designers and manufacturers to make available processes and equipment which are economically feasible for small plants.

A new bulletin dealing with storage and handling of jet fuels at airports has been published by the American Petroleum Institute marketing division. Its number is API Bulletin 1503—Fourth Edition.

A joint award was made at the Exposition of Chemical Industries to Texaco Inc. and Thompson Ramo Woolridge for a computer installed in March 1959 on Texaco's catalytic polymerization unit at Port Arthur, Tex. The Texaco unit was the first with closed-loop, on-line computer control.

Jet-fuel manufacturers may soon be asked by Military Petroleum Supply Agency to specify anti-icing additives in bids for Air Force JP-4 contracts. Phillips Petroleum Co., whose anti-icing additive has been approved for use in military aircraft, has granted licenses to Union Carbide Chemicals Co. and Dow Chemical Co.

A new gas plant has been started up at Sun Oil Co.'s Marcus Hook, Pa., refinery. Initial daily separating capacity is 14,400 M.c.f. of dry gas, 7,100 bbl. of propane and propylene, 13,200 bbl. of butane, and 18,000 bbl. of gasoline. The unit will also process liquids and mixed gases from an 84,000-bbl.-daily fluid bed catalytic cracking unit due for completion in October 1962. The gas plant was built by Catalytic Construction Co.

Water flood may double Zelten output

Esso Libya will pour $50 million into primary recovery project. Big-inch desert line will supply water from Mediterranean.

ZELTEN field, Libya's first commercial producer and so far the biggest known field in the country, is going to qualify for another first—this one world-wide.

Esso Libya plans a $50-million water-injection program designed to flood the Zelten reservoir acquifer with as much as 500,000 bbl. daily of Mediterranean Sea water.

The Jersey Standard affiliate shies away from the term unique in connection with the plan, but never before has so large a field been given this type of water treatment on such a scale, so early in its life. The project ranks with the world's biggest water floods, but all others this big are secondary recovery projects. The Zelten plan is definitely primary and is designed to maintain reservoir pressure from the early life of the field. Esso Libya believes its project will double the oil recovery from Zelten and produce it cheaper.

The project will require a 36-in. pipeline from Marsa El Brega on the Mediterranean coast to move the seawater 110 miles through the Libyan desert to the field. The company formally dedicated its 30-in. crude pipeline along the same route only last month (OGJ, Oct. 30, p. 120).

There is no definite timetable for the project as yet. The company is now wrestling with the political and economic problems posed by revisions in the Libyan petroleum law. Esso is going to have to decide—and soon—whether or not to agree to some basic changes in its original deal with Libya.

Well-studied field. The reservoir studies which gave birth to the mammoth project were begun almost immediately after the Jersey company brought in its Zelten discovery in June 1959, at the rate of 15,000 bbl. daily from a 205-ft. Paleocene limestone section topped at 5,400 ft. The second well was even better and tested 17,000 bbl. daily from a 300-ft. oil column with extremely good porosity.

The third well was completed in the Cretaceous about 2,000 ft. lower.

The big water flood is aimed strictly at the Paleocene reservoir on which Esso has placed development emphasis.

The Zelten reservoir has probably had as intensive and continual study as any in the industry's history with all the research and technical facilities of the Jersey organization taking part. The field now has 34 producers drilled about a mile apart. There is no formal grid-type well spacing and Esso does not contemplate any arbitrary spacing pattern. The spacing is based strictly on structural requirements.

The flood will be started with a minimum number of injection wells, probably as few as five on the periphery of the structure.

Flood plans. A minimum of water treating will be necessary, according to the Esso studies. The company plans to add some bacteriacides to the Mediterranean water at Port Brega and possibly corrosion inhibitors.

The 500,000-bbl. injection rate will in all probability boost the production from Zelten field into the 250,000 to 300,000-bbl. daily output range. This will make it necessary to install pump stations on the present 30-in. crude line. The present Zelten output is moving by gravity flow to the Mediterranean and the 1962 average throughput of the line is expected to be 125,000 to 150,000 bbl. daily.

India presses for product-price cut

Government pressure on private companies seen as another effort to make room in growing Indian market for cheap Russian products. Showdown near.

RUSSIAN oil again has a key role in a new Indian squeeze play on private companies, this time on product imports.

Last year, India tried — and worked—a similar squeeze on crude imports when it urged refiners to process Russian crude. The companies refused, but soon after reduced the price of their own imports from the Middle East. The general Middle East price cut followed soon after.

India this year set the stage for pressure on product prices by arbitrarily ordering discounts that will amount to an estimated $31.2 million in 1962. Of this, discounts on imported products will amount to $10.3 million. Discounts on bulk products refined locally will come to $10.3 million. The remaining reduction will be on distribution and marketing charges, and on profit margin. The new policy went into effect October 1 without prior notification to companies (OGJ, Oct. 16, p. 83).

Here is how the squeeze is being applied:

Foreign exchange allocated to companies for product imports will cover requirements only if the products are brought in at discounts off world prices. The hitch is that discounts are not normally available on imports of kerosine and high-speed diesel oil, the main products brought into India. This is because demand for these products east of Suez is higher than the supply available from Persian Gulf refineries.

If traditional Middle East sources can't supply enough products at discounted prices, companies are expected to turn to new sources where the discounts are available. In practice this would mean products from Russia or Romania.

Refusal by companies to buy products from "alternative" sources will mean that marketers will either have to take a loss on imports over and above their foreign-exchange allocation, or they can stop importing when the exchange quota is used up. If they stop imports, the government will make up the difference with imports from the Black Sea. This would give the new government marketing company a further foothold in the domestic market.

Discount effect. If and when the laid-down price of products imports are discounted off world prices, the reduction will force down the postings of domestically refined products. This is because the government's agreements with Stanvac, Caltex, and Burmah-Shell peg local product prices to imports.

The companies, as an alternative, are seeking permission to expand their refineries. This would permit them to increase imports of crude, now being brought in at a discount of about 18 cents per barrel, or about 9% off the CIF. (cost/insurance/freight) of crude imports. The result would be a saving in foreign exchange for India, while producer prices would continue to be on a parity with prices in the world market.

India has so far refused permission for companies to expand their capacity. It considers this a separate problem involving several other questions. One of these is India's continuing desire to have private refineries run Russian crude. The government is expected to press companies to agree to handle it.

India is attracted to Russian oil by double-edged offers from the soviets. On the one hand, Russia will lay down products in India at a lower cost than they can be brought in from the Persian Gulf. On the other, Russia will take payment in rupees, and save the country on scarce foreign exchange.

Drill ship will make first tests off Kuwait

THE Nola III, a floating drill ship that drills over the side, is heading for the Persian Gulf to sink the first tests in offshore Kuwait for Royal Dutch-Shell.

The first two wells planned for the Nola III—if they are productive—will be completed conventionally, but choice of the floating-ship-drilling equipment gives rise to speculation that Shell may be considering ocean-floor completions in this area. All subsea completions so far have been made with this type of equipment, and the U. S. affiliate of the Royal Dutch-Shell group has been active in work on underwater-completion techniques in Louisiana and at Shell Development Co. offices in Houston.

The Nola III has an initial 1-year contract and present plans call for two wells in the same area of the potentially rich marine concession. Location of the first two tests could not be definitely established last week, but they will probably be 40 to 60 miles offshore in waters only about 20 ft. deep. The tests are projected to 10,000 ft.

Royal Dutch-Shell won the Kuwait offshore concession a year ago in some of the most spirited competition for exploration acreage in modern oil history (OGJ, Dec. 5, 1960, p. 91).

Joint enterprise. The drilling operation by the Nola III is a joint venture of Zapata Off-Shore Co., Houston, and Southeastern Drilling Corp., Dallas. The two companies have formed Seacat-Zapata Offshore, S.A., a Panamanian company, which purchased the Nola III from Zapata and will operate it for Shell. Zapata will do the active drilling and Seacat will have the responsibility for supply.

Before sending the vessel on the long voyage to Kuwait, the owners

modified it to handle the big job of drilling in waters up to 135 ft. and far from base operations. It was fitted with larger mud pumps, larger living accommodations and galley, and a larger heliport.

Also added to the Nola operation is a work boat for supplying the vessel. The vessel is enroute to Kuwait with the Nola III. Two 50-ft. steel crew boats are being sent by commercial freighter. The four vessels will arrive by late January to begin drilling.

The concession consists of all of Kuwait's territorial waters beyond a 6-nautical-mile strip along the coast.

Japanese oil expansion helped by U. S. loans

AMERICAN oil companies and banks are showing confidence in the Japanese oil boom with heavy loans to Japanese oil companies.

The Japanese Government since the start of the year has authorized $58,910,000 in loans from U. S. sources. Authorization is pending on planned loans totaling another $124 million. This year's authorized loans and pending loans are on top of former loans which reached $62,-700,000 by the end of last year.

Some loans are being made by U. S. majors to affiliates in which they have half interest. But more are being made by banks and companies to Japanese firms which have no ties with the lenders.

Among sizable transactions:

Stanvac has loaned $10 million to Toa Nenryo, in which it has half interest.

Esso International—an affiliate of Jersey Standard, one of Stanvac's two parent companies—has loaned $6 million to Idemitsu Kosan, a large independent marketer and refiner. Idemitsu Kosan will use the money to build 130,000-ton tankers. Esso International also has loaned $5 million to New Asia Oil.

A $30-million loan is planned by Indiana Standard to Kyushu Oil, a new refining and marketing company, which possibly may be an outlet for some of Indiana's newfound crude in the Persian Gulf.

Gulf Oil has loaned $15 million to Nippon Mining, and plans to loan an equal amount to Idemitsu Kosan. Gulf has no interest in either company.

Caltex plans loans totaling $40 million to Nippon Petroleum Refining, which it owns jointly with Nippon Oil. This capital will finance a 100,000-bbl. refinery to be built at Negishi, near Yokohama. The plant is scheduled to go on stream in 1963. Loans will be repaid in 15 years.

Caltex also is loaning $4 million to Koa Oil, a smaller company in which it has half interest. Getty Oil plans to supply $5 million of $15 million to be borrowed by Mitsubishi Oil, which is owned 49% by Tidewater. The remaining $10 million will be supplied by banks.

Table contains a rundown on terms of loans.

What Japan's oil industry is borrowing

Companies	Source	Amount ($ million)	Repayment (yrs.)	Interest % annually
Authorized (Jan. 1, 1961, to date)				
Toa Nenryo	The First National City Bank of N. Y.	5	5	5.75
Maruzen Oil	Bank of America	10	5	5.75
General Gas	Chase Manhattan Bank	1.5	3	5.50
New Asia Oil	Esso International	5	6	5.50
Nippon Mining	Gulf Oil Corp.	15	12	4.50
Maruzen Oil	Bank of America	5	3	5.75
Toa Nenryo	Stanvac	10	8	5.0
Maruzen Oil	Continental Illinois National Bank & Trust of Chicago	1.41	5	6.0
Idemitsu Kosan	Esso International	6	6	5.5
		58.91		
Pending authorization				
Idemitsu Kosan	Gulf Oil Corp.	15	6	4.0
	Bank of America	20	5	5.75
Nippon Petr. Ref.	Caltex	40	15	5.5
Mitsubishi Oil	Getty	5	7	5.0
	Chase Manhattan	5	5	5.75
	The First National City Bank of N. Y.	5	5	5.75
Koa Oil	Caltex	4	..	....
Kyushu Oil	Standard Indiana	30	..	....
		124		

Japan emerges as major refining nation

SURGING refinery construction in Japan has pushed the country's capacity above 1 million barrels daily, and the country is now easily in the same class as Canada, Venezuela, United Kingdom, France, and West Germany as a major processing nation.

Crude-distillation capacity passed the million-barrel milestone late in September when Japan's total processing capability reached 1,019,390 bbl. daily. This included new facilities opened by both Mitsubishi Oil and Nippon Mining at Mizushima, Okayama Prefecture. The record level was a 49% increase in 9 months over capacity on January 1, as figured by the Petroleum Association of Japan.

Catalytic reforming capacity has reached 59,950 bbl. daily, up 45%. Hydrogen treating capacity of 46,000 bbl. daily is up 62%. There was no addition to catalytic-cracking capacity, which remains at 49,500 bbl. daily.

These three situations reflect a gasoline surplus, plus a need for higher octane and importation of heavier crude with a higher sulfur content.

Vacuum-distillation capacity is 175,060 bbl. daily, up 27%.

This year's addition to capacity tops off a 10-fold increase during the past 11 years. From the end of World War II until the end of 1949, the country's bombed-out refineries lay closed and untended. Rehabilitation began in January 1950.

Foreign oil flow high

New Libyan production, gains in Middle East, boost foreign crude output to highest level in 4 months.

LIBYA marked its second month as an oil-producing country in September with output of 33,900 bbl. daily, up from 21,600 bbl. daily in August.

All August output and about one-quarter of September production from Esso Libya's Zelten field was used to fill the 90-mile pipeline to the Mediterranean terminal at Marsa el Brega, and to fill field and terminal storage. The rest of the crude was exported in shipments before the official opening of Esso's terminal in October.

New Libyan production helped raise foreign crude output to the highest level in 4 months. Most of the increase, however, came from the Middle East, where gains were made in Kuwait, Saudi Arabia, and Iraq.

A new production record was set in Germany, where output from more than 100 small fields topped 125,000 bbl. daily for the first time.

Trend over the last year
(Thousands of barrels)

	Western Hemisphere less U. S.	Middle East	Total free world less U. S.
1960			
September	4,346.1	5,505.8	10,967.4
October	4,243.9	5,630.2	11,104.5
November	4,206.8	5,482.2	10,964.2
December	4,341.2	5,550.1	11,152.2
1961			
January	4,594.1	5,568.1	11,418.8
February	4,616.9	5,697.7	11,572.8
March	4,448.6	5,764.1	11,510.1
April	4,287.9	5,558.7	11,151.7
May	4,395.3	5,519.6	11,271.3
June	4,436.3	5,750.1	11,575.1
July	4,457.9	5,525.1	11,348.0
August	4,513.1	5,569.4	11,344.9
September	4,508.4	5,738.3	11,533.9

World-wide crude production: Daily average in thousands of barrels

Country—	Sept. 1961	Aug. 1961	Sept. 1960
Western Hemisphere			
Argentina	228.5	228.5	192.2
Bolivia	6.9	7.2	11.4
Brazil	95.0	95.0	88.9
Canada	651.0	635.0	521.8
Chile	27.8	28.2	20.8
Colombia	142.5	145.7	145.2
Cuba	0.2	0.2	0.2
Ecuador	8.4	8.4	7.5
Mexico	290.0	290.0	287.7
Peru	52.8	52.8	54.0
Trinidad	123.1	123.1	121.3
Venezuela	2,882.2	2,899.0	2,895.1
Total	4,508.4	4,513.1	4,346.1
Europe			
Austria	45.6	44.7	45.7
France	46.2	44.8	41.1
West Germany	125.1	122.8	107.3
Italy	38.6	38.7	40.1
Netherlands	39.1	37.8	37.0
United Kingdom	2.0	2.0	1.8
Yugoslavia	27.1	27.3	24.6
Total	323.7	318.1	297.6
Middle East			
Bahrain	45.0	45.1	45.1
Iran*	1,138.0	1,262.0	1,113.0
Iraq†	1,041.5	1,015.7	1,046.8
Israel	2.3	2.3	2.7
Kuwait	1,654.8	1,538.5	1,729.1
Neutral Zone‡	196.0	174.3	139.5
Qatar	184.7	168.6	173.3
Saudi Arabia	1,468.3	1,355.2	1,249.1
Turkey	7.7	7.7	7.2
Total	5,738.3	5,569.4	5,505.8

Country—	Sept. 1961	Aug. 1961	Sept. 1960
Other Asia			
British Borneo	83.0	83.0	95.2
Burma	10.5	10.5	12.9
India	8.5	8.5	8.5
Indonesia	431.4	425.5	386.9
Japan	13.5	13.5	10.0
New Guinea	2.5	2.7	4.3
Pakistan	5.9	5.9	5.9
Total	555.3	549.6	523.7
Africa			
Algeria	238.6	216.4	195.1
Angola	1.3	1.3	1.5
Egypt	71.7	71.7	59.7
Gabon	14.8	15.0	16.8
Libya	33.9	21.6	.....
Middle Congo	2.2	2.2	.....
Morocco	1.7	1.7	1.8
Nigeria	64.0	64.8	19.3
Total	428.2	394.7	294.2
Free world			
Foreign	11,553.9	11,344.9	10,967.4
United States	6,995.0	7,103.8	6,970.6
Total	18,548.9	18,448.7	17,938.0
Communist countries in soviet orbit			
Romania	234.0	234.0	231.0
Russia	3,316.0	3,316.0	3,027.0
Other Communist	100.0	100.0	100.0
Total	3,650.0	3,650.0	3,358.0
WORLD TOTAL	22,198.9	22,098.7	21,296.0

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking.
*Includes estimated 7,000 bbl. daily from Naft-i-shah field not operated by consortium companies. †Includes estimated 3,500 bbl. daily from Naft Khaneh field, operated by Iraq Government. ‡Includes offshore production by Japanese interests.

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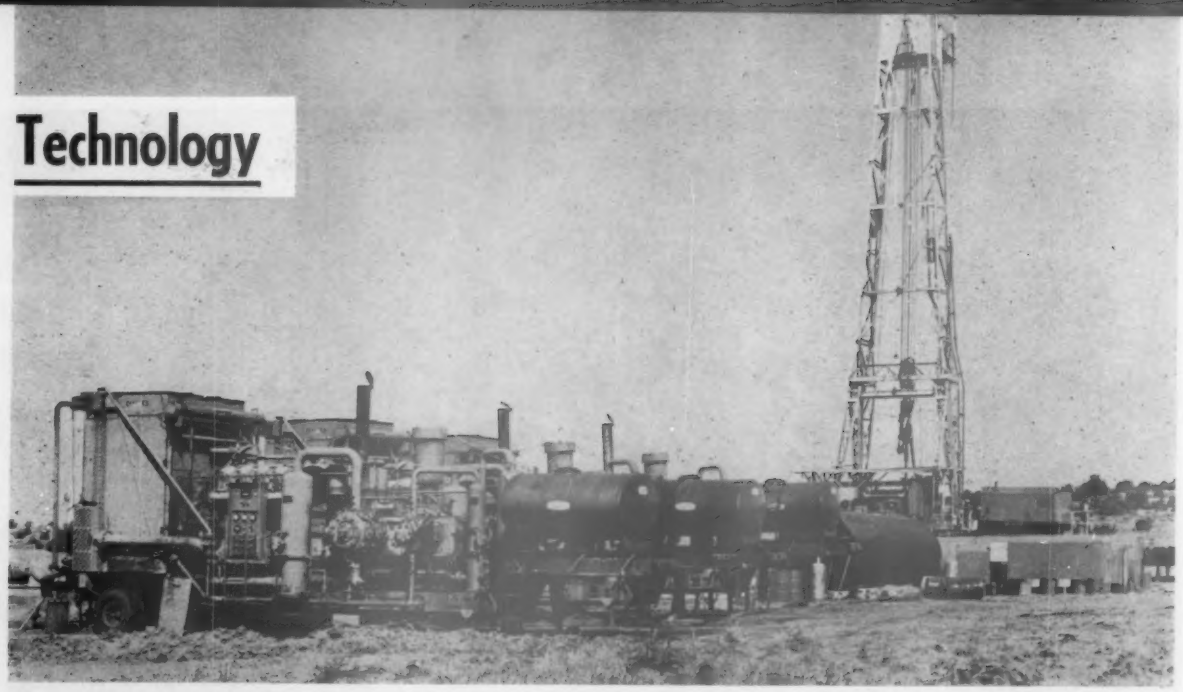


COMPACT TRAILER MOUNTING includes 780-hp. diesel engine and four-stage compressor as well as intercoolers and aftercoolers on air stream. Units are designed for high atmospheric temperature but low atmospheric pressure; as a result they can deliver full-rated air volume and pressure on mountain locations.

Big compressors put versatility

BY ED McGHEE
Drilling Editor

ROCKY MOUNTAIN drillers have access to new air-drilling equipment which, in effect, has its own booster compressor built in.

This important new equipment is a trailer-mounted, 550-hp. machine which compresses air in four stages. Earlier equipment was generally less powerful and customarily used only two or three stages. As a result of the great power and multiple-stage compression of the later units, their supplier believes the driller benefits in that:

1. There's no expense for a standby booster compressor.
2. There's no delay waiting for a booster to be brought to location.
3. A wider range of operations can be performed, such as "drying up" the hole from a great depth without "staging" the pipe into the well.

Net result of the four-stage compressor is to erase a disadvantage which drilling with gas-well gas formerly held over drilling with air. At times in drilling with either air or gas, it is necessary for short periods to use higher-than-normal volumes or pressures. With gas, there is often a reserve to meet the emergencies. Frequently in the past with air, there was expense and delay while a booster compressor was brought to location.

The new machines are offered on rental by Magnet Cove Barium Corp., or Magcobar. There is another "first" connected with the compressors—it is the first time a major drilling-fluids supplier has offered an air-drilling service along with the customary mud service.

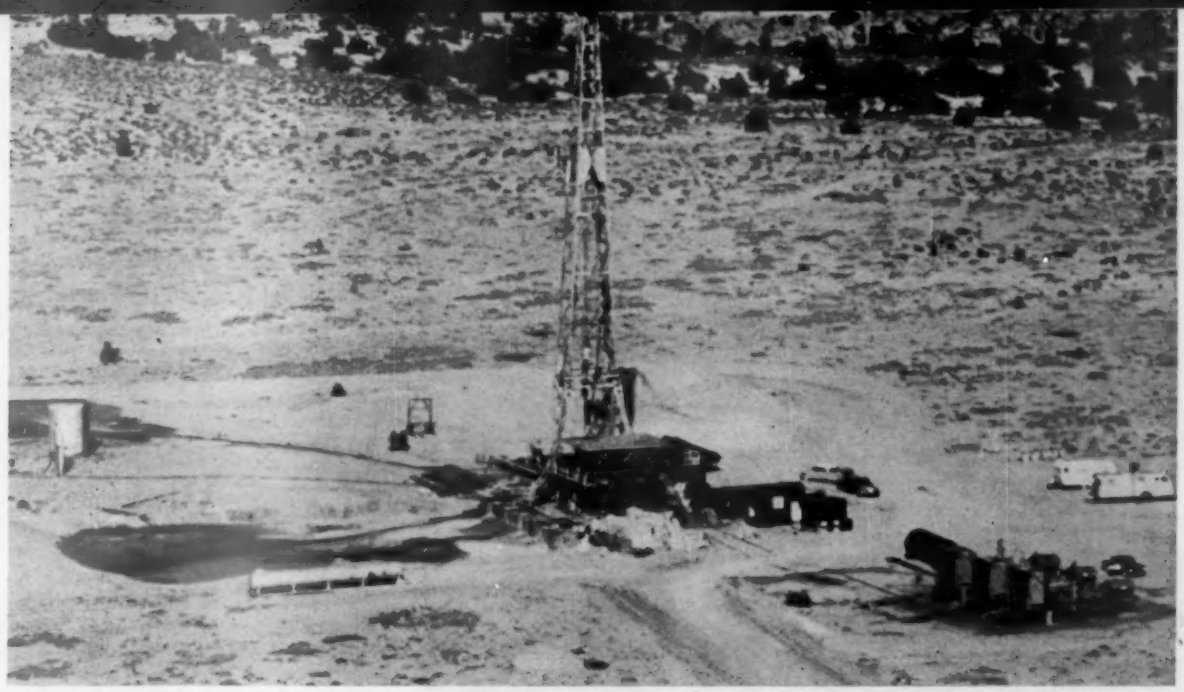
Magcobar has in the field three of the air-drilling packages, each of which contains a Clark Bros. Co. CFB-4 air compressor direct coupled to a 780-hp. diesel engine. More such units are planned.

Pictured on these pages are the three currently active machines on an air-drilling location near Moab in the northern extreme of Utah's Paradox basin. The well is Pure Oil Co. 5 Big Flat. Conditions of the job were extraordinarily demanding. A single machine, or two machines, could not furnish the volume of air required as they might on normal Rocky Mountain air-drilling jobs.

Pure programed a 13¾-in. hole to 5,000 ft. Throughout the lengthy drilling of this extra-large hole, the three machines reliably delivered the tremendous volumes and high pressures necessary to unload the hole and displace water. In fact, it was sometimes possible to operate one or more of the compressors at half load and still supply all air needed.

Inter, aftercoolers. The Big Flat job was on a location about 5,500 ft. above sea level. While this altitude might cause difficulty for compressors designed for lower elevations, it gives no pause to the new machines. These compressors are designed for the extreme conditions of 100° F. atmospheric temperature and 12 psia. atmospheric pressure (a pressure roughly corresponding to 5,000-ft. elevation).

Since 100° F. days are rare in the Rocky Mountains at elevations above 5,000 ft., the new compressors can normally deliver full rated



PARADOX BASIN LOCATION is backdrop for big air-drilling job which required three of the big, new compressors. Trailer-mounted machines are in line at right of rig. Four-stage compression in each machine makes booster compressor unnecessary.

into Rocky Mountain air drilling

New trailer-mounted compressors require no booster since they compress in four stages and are capable of as much as 1,180 c.f.m. at 1,250 psi. Big size simplifies piping at the rig; built-in heat exchangers keep outlet air temperature desirably low.

volume and pressure at elevations much higher.

Even with suction at 100° F. the new units can deliver 1,250-psi. air at only 150° F. Magcobar says this fact has three important results. First, more air can be circulated with less friction-pressure loss than at the high temperatures common to some smaller compressors. Second, rig equipment should last longer at the lower temperature. And, third, the compressor equipment itself should work longer without breakdown.

The important cooling function is built into the engine - compressor packages. On each trailer there is a forced-air heat exchanger which dissipates heat from both compressor and engine. There are three stages of intercooling and one stage of aftercooling for the compressor. There is also jacket-water cooling for both engine and compressor. Also, crankcase oil is cooled in the system.

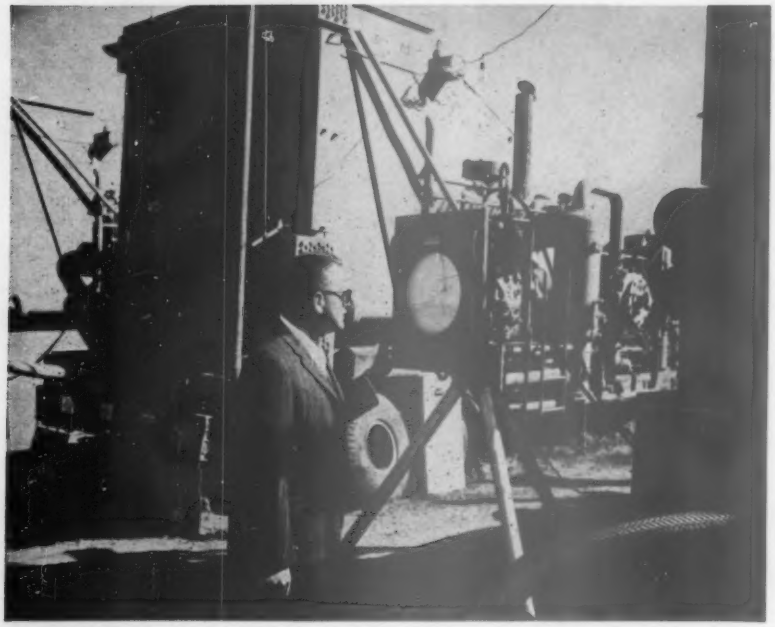
A scrubber removes water from the air after each of the first three stages of compression and cooling. On the outlet, a combination vessel removes water and also acts as a pulsation dampener.

Four stages to 1,250 psi. Mechanics of cooling is also tied to the number of compression stages. In any machine, the more compression stages used to reach some final pressure, the less heat is generated in each stage. As a result of the four-stage compression, Magcobar expects valves, rings, etc., to run cooler and last longer. Moreover, more compression stages mean smaller pressure differentials per stage and, as a result, longer compressor-parts life.

It is important to the oil producer or drilling contractor that the machine he rents last well; a lot of rig time can be lost as a result of compressor failure.

The Clark compressors are adaptations of machines which the firm has been building for more than 20 years. Hundreds of such compressors are in service on gas-gathering and gas - transmission lines. Little basic change was necessary to fit the machines for air compression.

Magcobar engineers use a direct drive between the compressor and the driving Waukesha VLRDB diesel engine; reason is to avoid any possible difficulties with clutches. The compressor valving can be easily adjusted to unload the machine when the engine is to be



AIR VOLUME, pressure, temperature are metered on each of the new compressor units. Though air is not sold by the cubic foot, driller still can see how much air he gets for his money. Three-pen orifice meter records static and differential pressures, from which volume may be calculated quickly.

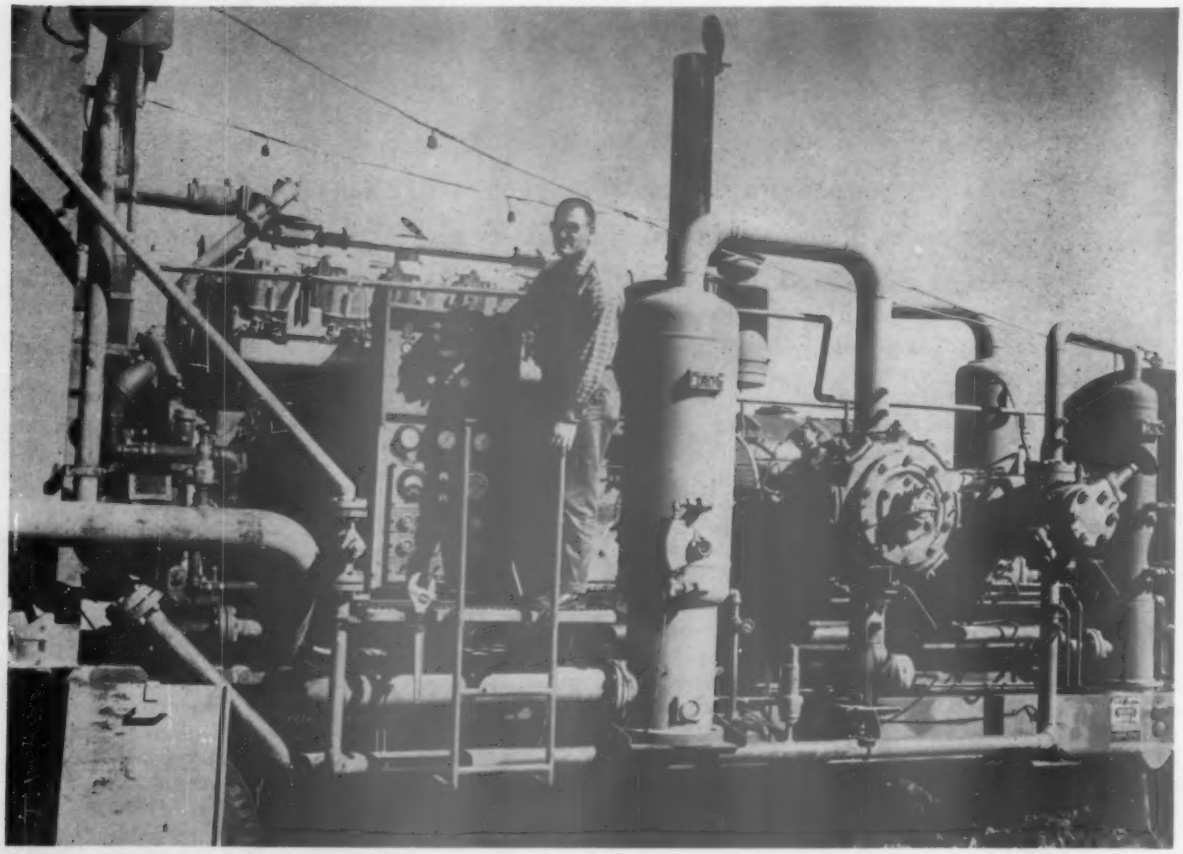
started or slowed to idling speed.

While the driving engine is rated to 780 hp., it is never required to furnish more than 550 hp. Automatic controls on the compressor adjust cylinder clearances and compression ratios so that engine power remains fairly constant. That is, at discharge pressures up to 500 psi., the machine delivers 1,550 c.f.m., requiring from 475 to 525 engine horsepower.

At pressures from 500 to 800 psi., the controls adjust to deliver only 1,450 c.f.m.; result is that engine horsepower varies only from 500 to 555 hp.

From 800 psi., up to full rate of 1,250 psi., delivery is automatically cut to 1,180 c.f.m.; thus engine horsepower ranges from 450 to 540.

Of course, there are times when not all the capacity of engine and compressor is needed. In such cases, the engine can be slowed from its normal 1,000 r.p.m. down to as little as 600 r.p.m. Moreover, a number of suction valves on the first



AUTOMATIC CONTROLS ON COMPRESSORS adjust cylinder clearances and compression ratios so that load on the driving engine is kept nearly constant. If not all of the engine output is required, it can be slowed to almost half speed. Compressors are adaptation of model often used on gas pipelines.

stage can be lifted to further cut air volume.

Recognizing that drillers might occasionally need only a fraction of the capacity of the big compressors, Magcobar offers to rent "half a compressor." The machine is run at half capacity and the cutomer is charged accordingly.

Accessories. Among the advantages attributed to the new equipment by its owner is simplicity of moving and rigging up on location. Since one large compressor takes the place of several smaller ones, there is less piping. All air lines, valves, checks, and fittings from machines to the rig standpipe, are furnished at no charge.

Moreover, to move the large machines requires only a fifth wheel; no lowboy trailers or flat-bed trucks are needed to transport them.

Along with the compressor service, there is provided a meter record of the volume of air being supplied. Each compressor unit carries its own three-pen recorder. One pen records delivered-air pressure, one records delivered-air temperature, and the third shows pressure drop across a metering orifice.

While the compressed air is not sold on a cubic-foot basis, it is metered to show the user what he is getting for his money.

Magcobar officials say that their machines may be ushering a new era in drilling-fluids programs. The company hopes to offer a **complete** drilling-fluid service ranging all the way from air to aerated mud to native muds to weighted muds. Thus, oil operator or contractor could reduce the number of suppliers with whom he dealt.

In the field. On the jobs undertaken by the new compressors, there has been no basic trouble with operation of the units. Once, a compressor was run for 7 hours at full rated pressure of 1,250 psi.; immediately afterwards, this same machine ran another 8 hours straight at that pressure. Magcobar reports that there were no visible signs of wear on compressor valves or other parts.

On another occasion, two of the compressors were used to "dry up" a hole at 2,200-ft. depth. This was done quickly in a single stage with a pressure of 950 psi. Afterwards, the two units teamed up to continue drilling the hole though only 200 lb. was required. Thus, the driller got the benefit of the high pressure without the expense of a booster compressor.

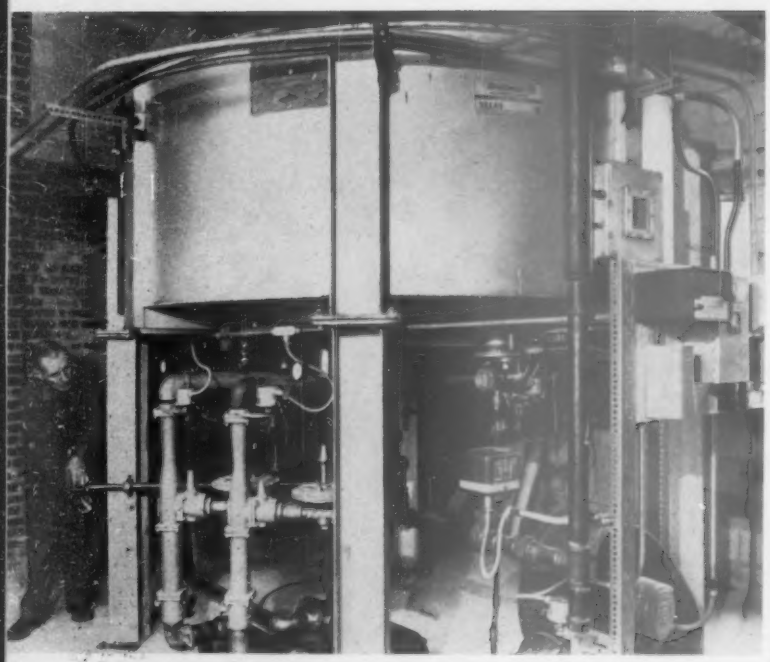
RETURN CUTTINGS AND WATER from well pile up at end of blooey line. High pressure of new compressors makes it possible to lift great quantities of water from the hole while drilling. Or, accumulated fluid can be unloaded from the hole without staging the pipe into the well.

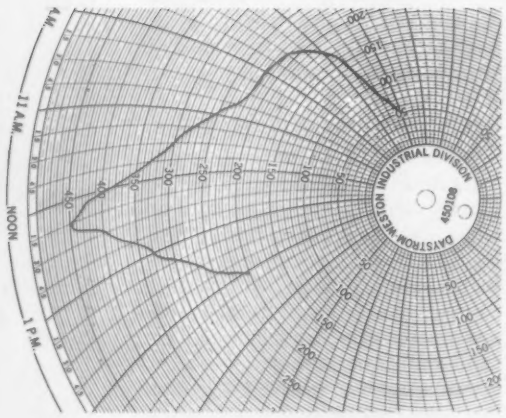
On the Pure Oil Co. job pictured here, the big compressors were helping the company to evaluate an area which had proved difficult with normal mud drilling and with conventional air equipment. At Big Flat, there is a salt section beginning at roughly 4,000 ft. and extending some 2,000 ft. in thickness. In the interval, there are one or more formations capable of producing oil.

In previous tests, mud had blocked the oil zones so that they could neither be located nor produced. For this reason, Pure chose to drill a large-diameter hole into the salt, and there set 10¾-in. casing. Further drilling with air or water would show the producing intervals without blocking them off. Successive strings of 7⅝ and 5½-in. casing would be set as the hole deepened.

Drilling 5,000 ft. of 13¾-in. hole in such hard formations would be quite slow and expensive with mud. It would require a great number of small compressors to deliver an air volume sufficient to drill the interval. For these reasons, Pure brought the three large compressors onto the job.

The big machines did their job satisfactorily and without undue incident.





THE RADIANT HEATERS below the processing kettle (see photo) not only provide a rapid temperature buildup and smooth climb to the peak level, but also permit rapid cooling (see chart).

Radiant heating cuts cost of batching lube grease

USE of radiant heat in place of steam is resulting in worth-while operating economics for Warren Refining & Chemical Co. at its Cleveland lubricating-oil and grease plant.

When the company sought to change process conditions to make certain special-formula heavy lubricants, the steam-pressure method of batching was found to have several shortcomings. It not only couldn't provide the increased flexibility, control, and heating accuracy required, but fuel costs became excessive in trying to reach correct temperatures.

Switching to a radiant system eliminated these inadequacies. Temperature increases up to and at peak levels now are accurately controlled within ±2° F.

As to cost factors, which were of major concern, the radiant system has cut processing time in half. Time for heating a full batch of lubricant to the desired temperature is now 4 hours instead of 8 hours. Cooling time is cut from 4 hours to 2 hours.

As a result, the increased production capacity and drastically lower operating costs of the entire new system is expected to be repaid within 2 years.

Heater design. The stepped-up production schedule stems from design features contained in the radiant-type heater, which was designed and built by Selas Corp. of America.

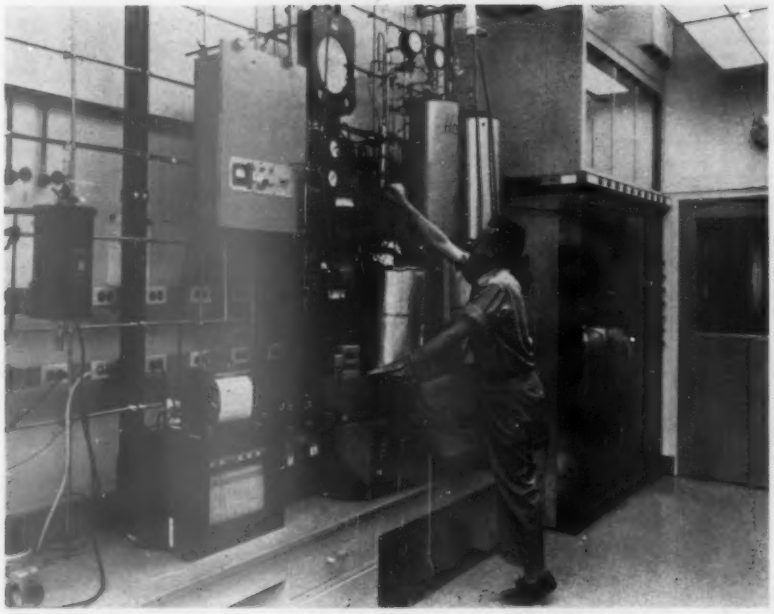
In this heater two groups of Duradiant burners are supplied gas and air properly mixed by low-pressure inspirators. Radiant heat is created by burning the mixture against special refractory surfaces of the burners. These cup surfaces, in turn, direct the radiant heat to the kettle bottom 10 in. above.

The controlled rate of heat transfer and close proximity of the heat sources to the kettle permit accelerated heating to be achieved. The burners produce no harmful flame impingement on the bottom of the kettle, which could cause hot spots and charring of the finished lubricant. Combustion is completed entirely within each cup.

With the new heating system it is possible to choose and follow exact cycles of heating and cooling. Once the temperature of the lube reaches the peak level, from 300° to 450° F., the burners are turned off and the batch completed by the addition of more base oil. As indicated on the recorder chart of one batch, quick cooling also is made possible by the rapid dissipation of heat from the burners.

Acknowledgment

This material is based on a report prepared by I. L. Carmichael, of Warren Refining & Chemical Co.



RESEARCH WORKER operates a flow reaction system in a typical modular laboratory unit in Monsanto's new research center at Creve Couer, Mo.

New lab geared for flexibility

ALL WALLS are movable in a typical modular laboratory unit in Monsanto Chemical Co.'s new research center in Creve Coeur, Mo. Utility piping is brought in overhead and dropped to workbench elevation.

This arrangement permitted a permanent installation of piping, even though walls and benches can be moved. Center section of the 22-by-30-ft. module (shown here) can house four 6-ft. hoods plus two 8-ft. distillation racks.

However, the area can be completely open or made into a walk-in type of hood. The hoods are a new design, built with three sliding-glass doors and a continuous air slot around the periphery.

The new research center, dedicated last month, ultimately will provide facilities for 800 scientific and supporting personnel.

Computer control for oxidation units

CELANESE CORP. of America will install a digital-computer system to control two of the four primary oxidation units at its chemical plant near Bishop, Tex. The computer will be an RW-300 supplied by TRW Computers Co. Celanese anticipates that the computer system will pay for itself within 2 years by increasing productivity and efficiency.

The computer will exercise closed-loop control over Bishop's noncatalytic vapor-phase process that converts natural-gas liquids to formaldehyde, acetaldehyde, methanol, ethanol, acetic acid, acetone, and other chemicals.

Bishop plant production is approximately 400,000 tons per year. Computer control will result in increased throughput and yield, through closer control of such factors as reactor temperatures and richness of feed stocks.

The computer will sense about 150 process variables and will control 24 process variables. It will automatically update the coefficients of the mathematical model stored in its memory, thus improving control action.

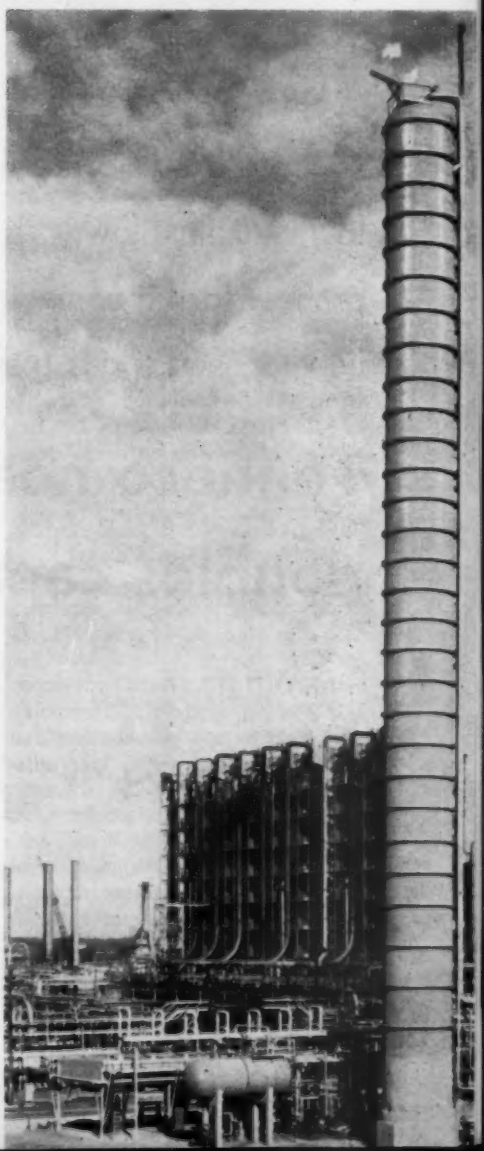
The computer will print out hourly and daily logs of operating data, and will continuously scan for abnormal conditions.

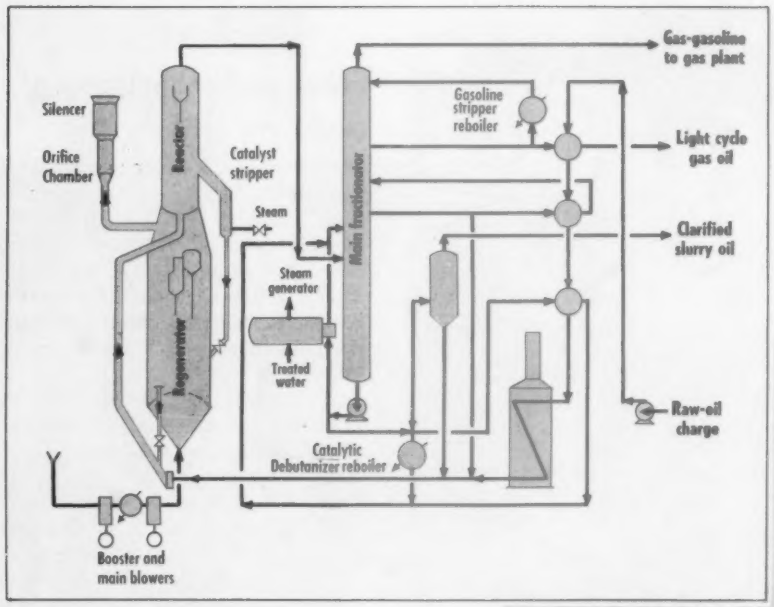
New superfractionator goes on stream

REACHING 220 ft. skyward, a superfractionator is on stream at Humble Oil & Refining Co.'s Baytown, Tex., refinery. The 14-ft. diameter is an intermediate step between the naphtha rerun unit and the paraxylene and aromatic distillation units.

The tower is a major link in Humble's expansion of orthoxylene to 25 million gallons yearly and paraxylene to 115 million pounds yearly. Humble's Baytown laboratories did much of the process development work for the project.

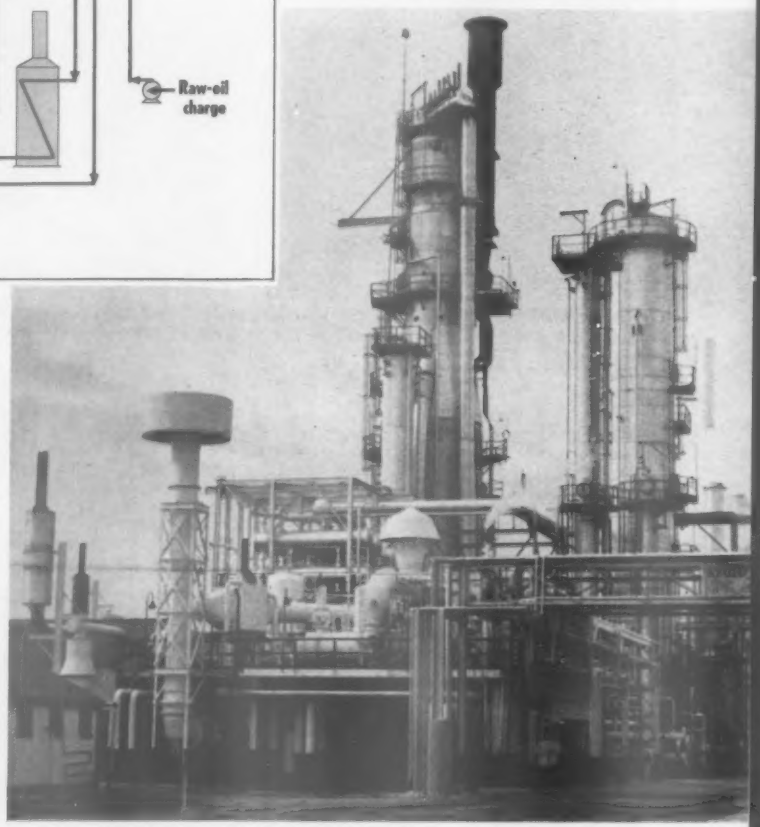
Construction took 10 months from design to production including time out for Hurricane Carla.





MAJOR FLOWS are shown of the revamped cat cracker. Rating was raised from 9,500 bbl. daily fresh feed to 17,500 bbl.

EVERY known technique was used by Tenneco Oil to almost double its cat cracker capacity at Chalmette, La. Booster blower (left) discharges into the main blower suction. Reactor-regenerator (center) were not changed, but main fractionator (right) was enlarged. Revamp also included a feed preheat furnace and a new gas plant.



By adding a booster blower to the main blower, a feed preheat furnace, main fractionator, and a gas plant . . .

Tenneco nearly doubles capacity of its cat cracker

AN OUTSTANDING revamping feat was performed by Tenneco Oil Co. with its cat cracker at Chalmette, La., when rating was raised from 9,500 bbl. daily fresh feed to 17,500 bbl. Catalyst circulation increased only 20%.

Tenneco did everything possible to raise capacity short of replacing the reactor and regenerator.

Revamp had other advantages, also.

- Plot space was saved by having only one unit.

BY H. C. BOZEMAN
Gulf Coast Refining Editor

- Yield of gasoline and liquid products increased because of more feed preheat and lower cracking severity.

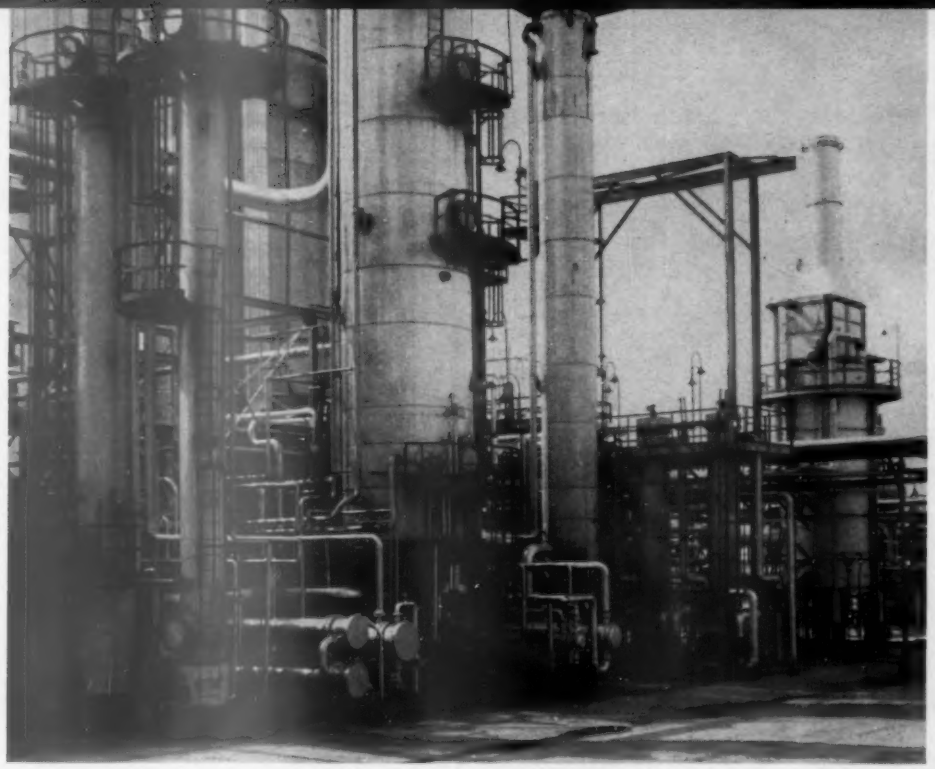
The revamp was done according to a broad plan. First, maximum gas velocities were set for reactor and regenerator. Other pieces of the plan then began falling into place.

Reactor and regenerator pressures were boosted to permit even higher feed rates at maximum gas velocities. Feed preheat was increased to lower coke make and air needs per barrel of feed and permit another boost in rates.

Further, higher gas-plant pressures would increase over-all propane and butane recoveries.

All equipment was enlarged to the limits set by these criteria.

Cat cracker revamp was part of Tenneco's modernization program at Chalmette refinery. The original



ANCHOR BOLTS on the new 10-ft.-6-in.-diameter main fractionator (center) are on the inside of the skirt. New 15 M.M. B.t.u. per hour heater (right) preheats the fresh feed.

refinery included a crude-distillation unit, a gas plant, and a cat poly unit.

A major modernization program was needed to raise capacity. Keys to modernization were that the cat cracker was expandable economically and the cat reformer had sufficient capacity.

A new 45,000-bbl.-daily crude-distillation unit replaced the original 25,000-bbl. unit. A 2,500-bbl.-daily HF alkylation unit replaced the old cat poly unit.

Cat cracker design capacity originally was 5,500 bbl. daily fresh feed. The unit had been expanded to 9,500 bbl. daily before revamp. It is a conventional UOP stacked reactor-regenerator with external catalyst circulation piping.

The revamp design case boosted capacity to 14,800 bbl. daily. Feed rates above design have been typical since revamp.

Revamp Design

Major capacity limitation for the revamp was that the reactor and regenerator vessels would not be enlarged. Everything else was revamped to the maximum imposed by this limitation. Design feed was 32° API gravity gas oil with a 45% point at 650° F.

Gas velocities would increase at the higher feed rates. Top limit chosen for reactor gas velocity was 2.75 ft. per second and regenerator was 2.1 ft. per second. Any method to keep velocities within limits would help raise feed rates.

The velocities chosen are among the highest anyone has operated with success. The usual high velocities are about 2.0 ft. per second. Catalyst carryover can become a problem at these higher velocities.

Pressure increase in the reactor and regenerator would help limit gas velocities below maximum. The 9,500-bbl.-daily rate pressures were 18 psi. in the regenerator, 10 psi. in the reactor, and 6 psi. in the main fractionator receiver.

However, reactor was designed for 50 psi. and regenerator for 35 psi. Thus, there was ample room for an increase of reactor and regenerator pressures.

Review of the main blower showed it was operating at capacity flow; however, its turbine driver was delivering only 2,000 hp. when it was capable of 2,800 hp.

A booster blower raised original blower suction pressure to 7 psi. and fully loaded the 2,800-hp. turbine. Original blower now delivers more pounds of air but at a higher pressure.

An intercooler was installed between the booster and main blower which would keep main blower discharge temperature below design level.

The booster blower increased regenerator pressure to 25 psi., reactor to 17 psi., and main fractionator receiver to 12.5 psi.

Feed preheat would reduce air needs for coke burnoff because of lower coke yield and this would minimize additional blower capacity needed for the expansion.

Feed was preheated in the 9,500-bbl.-daily operation by contact with the catalyst in the riser. In the revamp, a furnace was installed to increase feed preheat and reduce coke make.

These changes increased feed rate to 14,800 bbl. daily fresh feed. Reactor velocity was limiting for this case because of the light feed chosen which produced an unusually low coke yield.

Revamp Operation

The unit has operated successfully at 17,500-bbl.-daily fresh-feed rates. Higher reactor and regenerator pressures and a lower combined feed rate than predicted made possible the higher feed rates.

Actual operations have used a heavier feed stock (28.5° API) than design (32.0° API). Table 1 summarizes the operating conditions for the different feed rates.

The unit has a wide range of sta-

Table 1—Operations comparisons

Conditions—	Before revamp	Revamp design	After revamp
Feed, bbl. per day	9,500	14,800	17,500
°API	32.0	32.0	28.5
% at 650° F.	45.0	45.0	25.0
K (UOP) value	12.2	12.2	12.0
Yield, vol. %:			
C_3 and lighter (wt. %)	1.9	2.2	2.4
Propylene	5.5	5.1	5.0
Propane	2.0	2.0	1.9
Isobutane	5.7	4.5	4.9
n-Butane	0.9	1.5	0.8
Butylene	6.8	5.5	6.2
Debutanized gasoline	47.4	47.2	48.1
Light cycle	32.1	30.0	32.2
Clarified slurry	4.3	6.2	5.9
Coke (wt. %)	6.6	5.5	6.4
Reactor temperature, °F.	900	900	890
Pressure, psi.	10	17	18
Velocity, ft. per second	1.93	2.75	2.72
Regenerator temperature, °F.	1,065	1,125	1,155
Pressure, psi.	18	25	27
Velocity, ft. per second	1.96	2.1	2.3
Cat-to-oil ratio (based on total feed)	14.0	6.0	7.4
WHSV (fresh feed)	6.3	12.6	20.2
Conversion, %	62.2	62.3	63.2
Combined feed ratio	1.25	1.61	1.50
Combined feed temperature, °F.	360	660	640

ble operation. It has stable operation with rates as low as 5,000 bbl. daily fresh feed by shutting down the booster blower.

Other Changes

Main fractionator and gas plant were revamped to match the higher feed rates to the reactor.

Main fractionator was enlarged from 9-ft. diameter to 10-ft. 6-in. diameter. The old main fractionator was capable of handling products from only 12,600 bbl. daily fresh feed even with new high-capacity trays. The added cost for the new tower had an attractive payout.

The new fractionator was placed on the same pedestal but with anchor bolts on the inside of the skirt. An analysis of the foundation and pedestal supporting the main fractionator showed it could support the new tower without change.

Main fractionator has three pumparounds. Light cycle oil (top pumparound) reboils the gasoline stripper in the gas plant. Heavy cycle oil (middle pumparound) preheats the feed and also is recycled. Slurry (bottom pumparound) is divided into three streams besides recycle. One stream generates steam, another preheats the feed, and the third reboils cat gasoline debutanizer bottoms.

Also added were parallel banks of overhead condensers.

Gas-plant pressure was raised from 140 psi. to 200 psi. All towers were enlarged and replaced. These were the stripper, primary absorber, sponge absorber, and debutanizer.

The new absorber-stripper system has 66 trays compared with 44 trays for the old system. Propane recoveries in the new unit are increased, Table 2. Main fractionator overhead liquid is used as lean oil to the primary absorber. Light cycle oil is used as lean oil to the sponge absorber.

The gas plant also serves the crude unit, alkylation unit, and cat reformer.

Table 2—Gas-plant recoveries

	Old	New
C_3	70%	92%
C_4	90%	99%

Compressor horsepower was doubled by addition of a new compressor. Gas-plant capacity can be increased further by supercharging this machine. Most of the heat-exchange and pumping equipment was reused. Old pumps changed services and most impellers were enlarged. Some reciprocating pumps were replaced with centrifugal pumps to reduce the amount of oil in the condensate.

Booster blower is driven by a steam turbine operating with 600-psi. superheated steam. Exhaust is 150 psi. to the unit's steam system. The exhaust plus that generated by slurry-oil exchange drives the main blower turbine and steam-driven pumps with about 5,000 lb. per hour going to the refinery steam system.

Alterations also were made to the cyclones, catalyst-withdrawal method, and catalyst-circulation lines.

Dip legs of the two-stage reactor cyclones are not sealed in catalyst, but have flapper valves on the outlets. Regenerator cyclones are sealed.

Catalyst-bed levels in both reactor and regenerator are low with only a depth of several feet in the dense phase.

Catalyst addition is continuous. Withdrawal of equilibrium catalyst is batchwise and is done for metals-contamination control.

The inside of the reactor riser piping is hardfaced for erosion protection. Cyclones are refractory lined and have operated at 1,200° F. for short periods without damage.

The unit was offstream for 40 days for final tie-ins. Procon, Inc., a Universal Oil Products Co. subsidiary, was the contractor.

Operating Experience

The unit was turned around after a year's operation at the higher rates. Condition was excellent except for some erosion in the slurry system. Tenneco hopes to extend runs to 2-year intervals after it makes the next inspection scheduled for next spring.

Principal problems experienced in the first year's operation resulted from high catalyst carryover from the reactor to main fractionator. Items most seriously affected were replaced with equipment and linings more resistant to erosion.

Loss of the booster blower through failure of either the blower or 600-psi. steam system has not resulted in a unit shutdown. An auxiliary suction direct from the atmosphere was provided for the main blower. A butterfly valve opens this suction and returns regenerator and reactor pressures to those experienced before revamp. The unit has a capacity of about 11,500 bbl. daily with the main blower only because of lower coke yield with the preheated feed.

The shorter contact time between catalyst and oil results in a less refractory slurry oil. Gravity of the slurry oil is 23° API and has a K (UOP) value of 11.6. Usual value is 10.5. A higher K value represents a lower aromatics content.

STILL GROWING is American Cyanamid Co.'s Fortier plant on the bank of the Mississippi River near New Orleans. Due on stream in 1963 are new facilities for methyl methacrylate monomer from hydrocyanic acid. Ammonia facilities are also being expanded. Besides hydrocyanic acid and ammonia, American Cyanamid's Fortier plant produces acrylonitrile, acetylene, and ammonium sulfate. Basic raw material is natural gas.

CONSTRUCTION REPORT

Petrochemical capacity still climbing fast

Nearly 100 new plants or expansion jobs are in the works in the U. S. and Canada. High on the list are olefins, ammonia, aromatics, polyolefins, alcohols, and naphthalene.

BY ROBERT B. BIZAL
Editorial Research Director

THE PETROCHEMICAL branch of the industry continues to lead the way in the number of new plant - construction projects under way or planned.

The latest count by The Oil and Gas Journal shows 97 projects in the U. S. and Canada—85 in the U. S. and 12 in Canada.

Naphthalene, one of the newest entries in petrochemicals, will be made at 8 new plants. Aromatics are still going strong with 10 projects.

Both these materials are used in manufacture of phthalic anhydride, and, in fact, there are now seven phthalic anhydride construction projects.

These include one in Puerto Rico, which will derive its raw material from Commonwealth Oil Refining Co.'s proposed naphthalene plant there. Stepan Chemical Co. is building the phthalic-anhydride plant.

Ammonia-plant construction is by no means at a standstill, although the industry is plagued by overcapacity and low prices. There are currently about 12 ammonia-plant construction projects.

Projects for olefins and derivatives are planned or under way at 13 locations. These include the world's largest ethylene plant — Monsanto Chemical Co.'s 500,000,000-lb. per year plant at Chocolate Bayou near Alvin, Tex.

Polyolefin construction is not far behind the olefins, with eight projects in the mill.

Other projects high on the list are methanol and higher alcohols with nine new construction or expansion programs, vinyls with more than a half-dozen, and rubber with five.

Another significant aspect of the new petrochemical construction report is Marbon Chemical's project to make styrene from extracted ethylbenzene. The 75,000,000 - lb. per year plant at Baytown, Tex., will be the largest styrene plant using extracted ethylbenzene as the base.

Two more oil companies have recently entered the petrochemical

field. Skelly Oil Co., in a 50-50 partnership with Swift & Co., has formed Hawkeye Chemical Co., and Union Texas Natural Gas Corp. plans a big complex with Allied Chemical Corp.

Following is a company-by-company summary of current construction projects:

AIR PRODUCTS & CHEMICALS, INC. (For joint project, see Tidewater listing.)

AIR REDUCTION PACIFIC CO. will build an ultrahigh-purity hydrogen-gas-producing unit at Richmond, Calif., using natural gas as feed stock. The $1-million plant is due for completion April 1962.

ALLIED CHEMICAL CANADA, LTD., plans a multimillion-dollar plant in Ontario for production of diisocyanates. Site not known.

ALLIED CHEMICAL CORP., General Chemical Division, is building a phthalic anhydride plant at El Segundo, Calif., with Ralph M. Parsons Co. contractor.

AMERICAN CYANAMID CO., Avondale, La., will go on stream in 1963 at a new plant with capacity of 30,000,000 to 35,000,000 lb. per year of methyl methacrylate monomer. Principal raw material will be hydrocyanic acid. Ammonia facilities are also being expanded.

AMERICAN OIL CO., Texas City, will build an anhydrous-ammonia plant, with construction to begin soon. Exact size not yet determined.

At Yorktown, Va., American will complete new heptene facilities in January 1962. Raw material will come from refinery streams.

ANCON CHEMICAL CORP. (Continental Oil Co. and Ansul Chemical Co.) will complete new facilities at Baton Rouge, La., early in 1962 for production of 60,000,000 lb. per year of methyl chloride. Blaw-Knox Co. is contractor for the plant which will cost more than $1 million.

ARMOUR AGRICULTURAL CHEMICAL CO., Nitrogen Division, is to complete a new plant at Cherokee, Ala., early 1962, with capacity for 360 tons per day of ammonia, 50 tons of urea, 300 tons of nitric acid, 250 tons of ammonium nitrate, 500 tons of ammonium phosphate, and 250 tons per day of nitrogen solution. Raw material will be natural gas.

AURORA GASOLINE CO., Detroit, has awarded contract to Procon, Inc., for new Platformer, Unifiner, and Udex extraction unit. Aurora will supply Dow Chemical Co.'s Bay City petrochemical plant with about 20,000,000 gal. per year of benzene and toluene. Completion mid-1962.

BORDEN CO., Geismar, La., will complete facilities in 1962 for production of vinyl acetate (50,000,000 lb. per year of monomer) and methanol (25,000,000 gal. per year). Cost is about $20 million.

BRITISH AMERICAN OIL CO., LTD., Clarkson, Ont., will start construction of new facilities to make cyclohexane from benzene early 1962, with completion fall of 1962.

At Montreal East, British American will build facilities to make benzene from toluene, with work to start early 1962.

CALIFORNIA CHEMICAL CO., Oronite Division, is building a phthalic anhydride plant at the California Oil Co. refinery at Perth Amboy, N. J., with capacity of 30,000,000 lb. per year. Completion late 1962. Contractor Badger Manufacturing Co.

At Richmond, Calif., California Chemical is increasing capacity for orthoxylene, paraxylene, and polybutenes.

CANADIAN FINA OIL, LTD., is building a gas-processing plant at Wildcat Hills field, Alberta, which will include capacity of 50 long tons of sulfur per day. Completion due January 1962.

CARY CHEMICALS, INC., is building a polyvinyl chloride plant near Burlington, N. J., on a 66-acre site on the Delaware River. Blaw-Knox Co. has contract. Capacity 100,000,000 lb. per year. First part of program due for completion by summer 1962.

Cary also plans a 50,000,000-lb. polymer plant for either the Midwest or Gulf Coast area.

CELANESE CHEMICAL CO., Division of Celanese Corp. of America, is building facilities for acetaldehyde from ethylene at Bay City, Tex. Also, facilities are being built for production of 2-ethylhexanol to replace those at Bishop, Tex., with completion 1962.

At Bishop, Celanese is building facilities for commercial production of a new polyacetal resin, with completion reportedly scheduled by January 1962.

CHEMOIL CORP., has plans for a new refinery between Baton Rouge and New Orleans, with output to include such petrochemicals as ethylene and propylene.

CITIES SERVICE PETROLEUM CO. is building a 50,000,000-lb. per year naphthalene plant at East Chicago, Ind., using distillate stocks. Contractor is Catalytic Construction Co. Cost is reportedly $2 million.

CLIMAX CHEMICAL CO. is building a sulfuric acid plant at Hobbs, N. M., using hydrogen sulfide and recovered sulfur as raw materials. Capacity will be 150 tons per day when completed spring 1962. Leonard Construction Co. has contract.

COLLIER CARBON & CHEMICAL CORP. (For joint project, see Tidewater listing).

COLUMBIA HYDROCARBON CORP., Siloam, Ky., is planning ethylene facilities at existing fractionation plant.

COMMONWEALTH OIL REFINING CO., Ponce, Puerto Rico, will build a $6.5-million plant—the firm's initial move into petrochemicals. The plant will produce 50,000,000 lb. per year of naphthalene, using UOP's Hydeal process. Project will include other products. Construction to start January 1962 at the company's Guayanilla Bay refinery, and completion set for January 1963.

COOPERATIVE FARM CHEMICALS ASSOCIATION, Lawrence, Kans., is increasing nitric acid production to 480 tons per day and nitrate facilities from present capacity of 450 tons to 600 tons per day. Completion late fall 1961.

DIAMOND ALKALI CO., Deer Park, Pasadena, Tex., will complete new facilities for 40,000,000 lb. per year of acetylene from methane and oxygen in January 1962. Scheduled for completion February 1962 are facilities for ammonia. Capacity will be 100 tons per day.

DOW BADISCHE CHEMICAL CO., Freeport, Tex., will complete facilities for 40,000,000 lb. per year of caprolactam in January 1962.

DOW CHEMICAL CO., Plaquemine, La., will complete a second polyolefin plant in second quarter 1962, capable of producing medium and high-density polyethylene, copolymers of ethylene, and polypropylene.

DOW CHEMICAL OF CANADA, Fort Saskatchewan, Alta., is building facilities for making weed killer.

At Sarnia, Ont., Dow is building facilities for propylene oxide, propylene glycol, polyglycol, polyethylene, and polypropylene.

DU PONT DE NEMOURS & CO., E. I., Huron, Ohio, will build plant for 30,000,000 gal. per year of methanol from natural gas, with completion early 1963.

At Montague, Mich., Du Pont will build a plant for 50,000,000 lb. per year of actylene from hydrocarbons, with completion late 1962.

At Orange, Tex., Du Pont is building plant for low-density polyethylene, with completion late 1962. Also scheduled is production of vinyl resins.

ESCAMBIA CHEMICAL CORP. will begin making urea solutions early 1962 at its 20,000-ton per year plant at Pace, Fla.

The company also plans to build a methacrylic-acid plant. Site not known.

GOODRICH-GULF CHEMICALS, INC., Institute, W. Va., will complete new plant to make polybutadiene early 1962. Capacity will be 20,000,000 lb. per year. SBR capacity is being increased by 8%, with completion by end of 1961.

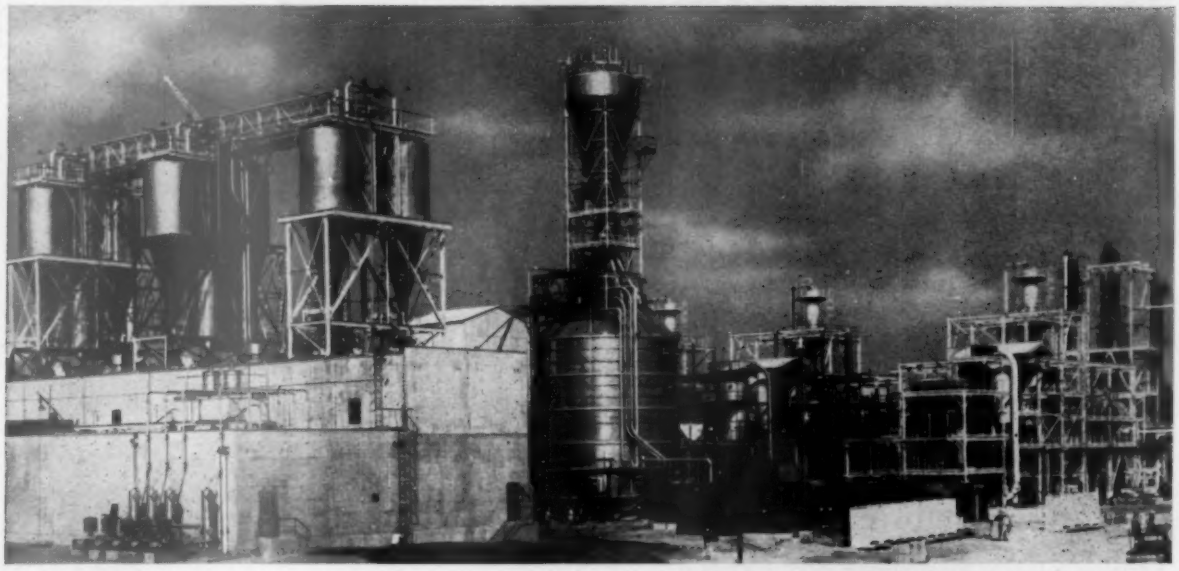
GOODYEAR TIRE & RUBBER CO., Beaumont, Tex., will go on stream with 20,000 tons of polyisoprene capacity spring 1962.

GRACE & CO., W. R., Nitrogen Products Division, will complete a 60,000-ton per year ammonia plant at Big Spring, Tex., in 1962.

GULF OIL CORP. is building a new ethylene plant with more than 400,000,000 lb. per year capacity in Harris County near Houston. This will more than double the company's present ethylene production when completed mid-1962. Plans also call from propylene and other chemicals at the site.

At Philadelphia, Gulf will complete new benzene and cumene plants early 1962.

HAWKEYE CHEMICAL CO. (formed by Skelly Oil Co. and Swift & Co.) will have capacity of about 300 tons per day at a new plant near Clinton, Iowa, with ammonia, nitric acid, nitrate solution, ammonium nitrate, urea, and nitrogen solutions as principal products. It will cost more than $10 million.



THE WORLD'S LARGEST polypropylene plant is now completed and capable of producing 100,000,000 lb. per year. Located at New Castle, Del., it was dedicated by AviSun Corp. earlier this fall. AviSun is equally owned by American Viscose Corp. and Sun Oil Co.

HERCULES POWDER CO., Lake Charles La., will complete a second polypropylene plant with a capacity of 60,000,000 lb. per year in 1962.

HOUSTON CHEMICAL CORP., Beaumont, Tex., will complete an 80,000,000-lb. per year ethylene oxide and ethylene glycol plant late this year.

HUMBLE OIL & REFINING CO., Baton Rouge, La., is expanding oxo alcohols from 90,000,000 to 120,000,000 lb. per year, with provision to take 2-ethylhexanol and hexadecyl alcohol. Completion expected early 1962.

At Baytown, Tex., orthoxylene and paraxylene capacity was due for completed expansion late 1961, while benzene capacity will be increased to 55,000,000 and toluene to 55,000,000 gal. per year early 1962.

At Linden, N. J., ethylene capacity is being expanded from 130,000,000 to 175,000,000 lb. per year, with completion early 1962. By mid-1962, new facilities for making methyl isobutyl ketone will be completed.

ILLINOIS FARM SUPPLY CO., INDIANA FARM BUREAU COOPERATIVE ASSOCIATION, and others reportedly plan to build a plant for anhydrous ammonia, ammonium nitrate, and nitrogen solutions in either Illinois or Indiana, with capacity of about 250 tons of ammonia per day.

JEFFERSON CHEMICAL CO., INC., Conroe, Tex., will add another piperazine unit during second quarter 1962. The product is an ethylene oxide-derived specialty chemical.

JEFFERSON LAKE PETROCHEMICALS OF CANADA, LTD., East Calgary field, Alberta, will have production capacity of about 860 long tons per day of elemental sulfur at a new gas-processing plant to be completed here late 1961 by Petrogas Processing, Ltd.

At Savanna Creek, Alta., Jefferson Lake will recover sulfur at new gas-processing plant to be completed by Saratoga Processing Co., Ltd., late 1961. Sulfur capacity will be 375 long tons daily.

MARBON CHEMICAL, Division of Borg-Warner Corp., will build a plant at Baytown, Tex., to make styrene from ethylbenzene. Capacity will be 75,000,000 lb. per year.

MOBIL CHEMICAL CO., Beaumont, Tex., will complete construction February 1962 at a 2,300-bbl. per stream day pyrolysis gasoline-hydrogenation unit and a 12,500-bbl. Udex unit for benzene recovery. Benzene capacity will be more than 30,000,000 gal. per year.

MONOCHEM, INC. (owned jointly by Borden Co. and U. S. Rubber Co.) is building a $20-million plant at Geismar, La., to make acetylene and vinyl chloride monomer, with completion by Chemical Construction Corp. and United Engineers & Constructors, Inc., in late 1962. Methanol capacity will be 75,000 gal. per day, with completion of this unit first half 1962.

MONSANTO CHEMICAL CO., is building a large petrochemical complex at Chocolate Bayou, near Alvin, Tex., with completion late 1962. It will include the world's largest ethylene plant with capacity of 500,000,000 lb. per year. Other capacities: 42,000,000 gal. per year of benzene. 50,000,000 lb. per year of naphthalene, and 50,000,000 lb. per year of phenol. Other facilities will include propylene, cumene, acetone, and ethyl benzene, plus a new flexible oxo-alcohol unit for normal butanol, isobutanol, isooctanol, isodecanol, 2-ethylhexanol, and other such alcohols.

In Gloucester County, New Jersey (near Camden), Monsanto will complete a plant to produce phthalic anhydride and phthalate ester plasticizers from naphthalene early 1962.

At Muscatine, Iowa, Monsanto will build a 200-ton per year ammonia plant, with completion fall 1962.

NALCO CHEMICAL CO., Freeport, Tex., is building a plant to convert about 26,000,000 lb. per year of lead to alkyls, which is equivalent to 40,000,000 lb. of TEL or 34,000,00 lb. of TML. Completion is scheduled for June 1962. Cost will range from $8 to $10 million. Fluor Corp., Ltd., has contract.

NATIONAL PETRO CHEMICAL CORP. (formed by National Distillers & Chemical Corp. and Owens-Illinois Glass Co.) will own the 60,000,000-lb. per year linear-polyethylene plant now under construction on the Houston Ship Channel. U. S. Industrial Chemicals Co., parent company of National Distillers, will operate the plant which is scheduled for completion late 1962.

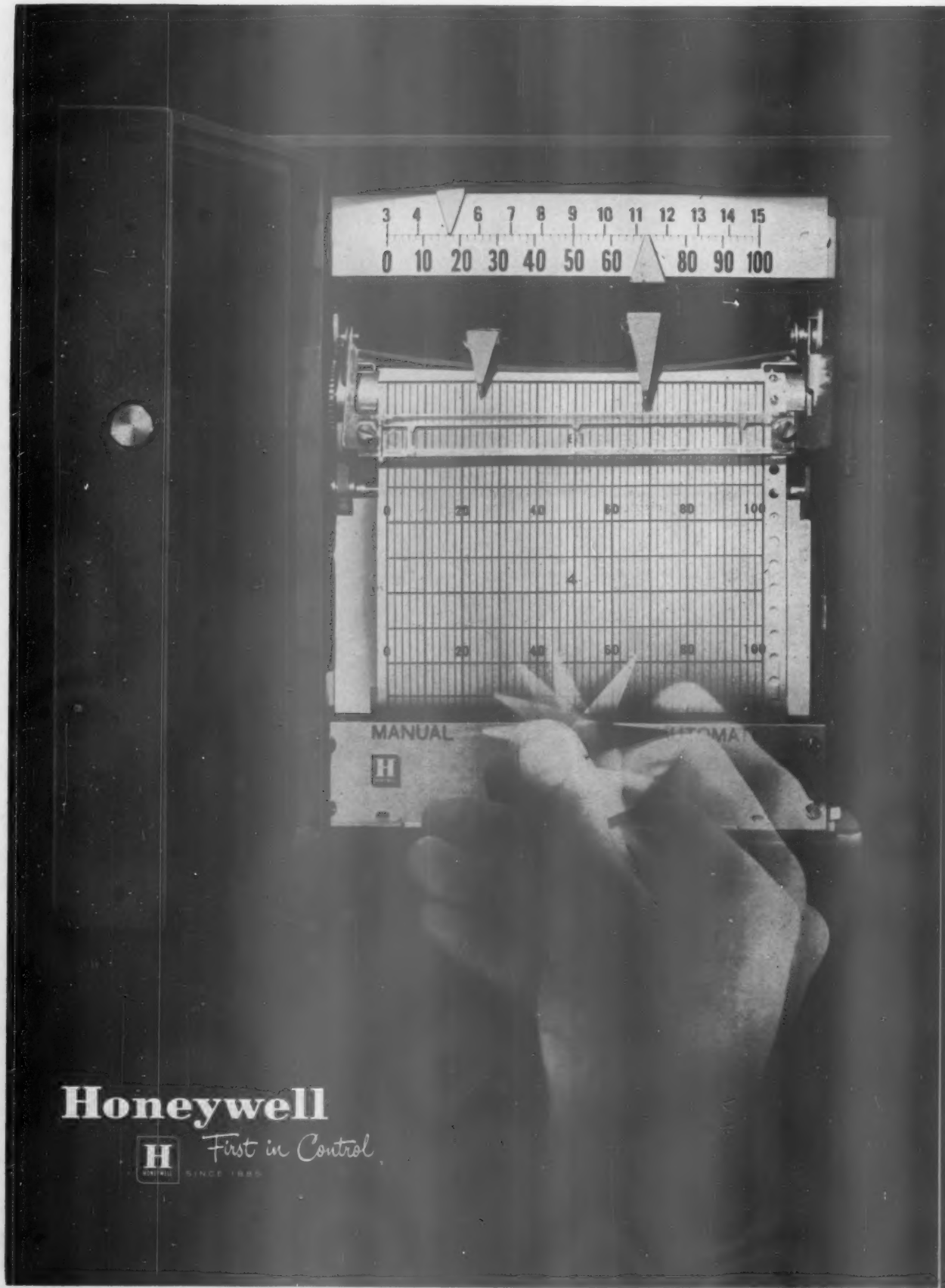
NATIONAL STARCH & CHEMICAL CORP. will build a $4-million vinyl acetate-monomer plant at Seadrift, Tex., with capacity of 45,000,000 lb. per year. Brown & Root, Inc., has contract. Completion scheduled for fall 1962.

NOPCO CHEMICAL CO., will go on stream early 1962 with an isocyanate plant near Linden, N. J. Capacity 10,000,000 lb. per year. Bechtel Corp. has contract.

NOVAMONT CORP., subsidiary of Montecatini, will build a film plant adjacent to the company's newly completed isotactic-polypropylene plant at Neal, W. Va.

OLIN-MATHIESON CHEMICAL CORP., Brandenburg, Ky., is building a 40,000,000-lb. per year glycerin plant, with completion spring 1962.

OXO CHEMICALS CO. (owned by Amoco Chemicals Corp. and Pittsburgh Chemical Co.), will complete a multimillion-pound per year isooctyl and decyl alcohol plant at Haverhill, Ohio, early 1962.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New Honeywell PneumatiK Tel-O-Set Instrumentation

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Automatic Switching Just a flip of the control lever switches the instrument from automatic to manual or vice versa. There are no bumps, no delays, no matching of pressures required. This simplified switching makes cascade control systems practical for the operator.

Easily accessible adjustments Zero and damping adjustments to pen can be made while the pen is recording. Effects of adjustments can be seen *while* they are being made. Since it is not necessary to withdraw the recording chassis to make adjustments, there is no possibility of causing a pen zero shift.

Interchangeable chassis and controllers Recording and indicating chassis are interchangeable. Just pull out one chassis and plug in the other. Quick-connect air terminals eliminate the need for tubing connections. Two- and three-mode controllers with backset adjustments are also completely interchangeable.

Easy-to-read, easy-to-change 4-inch charts Pen position on the 4-inch chart permits instantaneous reading of variables at all times. Pen arm design also permits rectilinear recording. Front-loading, tilt-out chart drive makes it easy to change chart rolls in a matter of minutes.

All cases fit 6 x 6 cutouts All models fit standard panel cutout of 6″ x 6″. Overall dimensions: 6¾″ wide; 7½″ high; 15¼″ deep.

Calibrated control adjustment Adjustments to controller can be easily made from back of the panel by removing controller cover. Calibrated dials for each adjustment ensure precise setting of proportional band, reset and rate values. Optional front-set control adjustments make it easy to set control from front of panel.

Easy to remove components To remove any particular component from the case, it is only necessary to loosen a screw or lift a latch.

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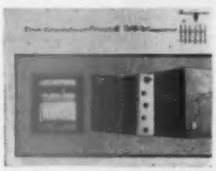

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CONSTRUCTION REPORT

PAN AMERICAN PETROLEUM CORP., Windfall field, west of Whitecourt, Alta., will have capacity for recovery of 650 long tons of sulfur per day at a new gas-processing plant. Completion 1962.

PENNSALT CHEMICALS CORP., Wyandotte, Mich., will nearly double capacity of an alkyl-amines unit here, with completion early 1962. Cost of project is reportedly $2 million.

PETROGAS PROCESSING, LTD. (See Jefferson Lake Petrochemicals listing.)

PITTSBURGH PLATE GLASS CO., Chemical Division, is building a methyl chloroform plant at Lake Charles, La. Completion in 1962.

POLYMER CORP., LTD., Sarnia, Ont., was due to complete facilities for production of 20,000 tons per year of polybutadiene synthetic rubber before end of 1962. Also due for completion late 1961 were facilities to produce a range of black masterbatch rubbers.

PURE OIL CO. reportedly plans a 30-ton per day ammonia plant at Worland, Wyo.

REICHHOLD CHEMICALS, INC., will have facilities to produce vinyl acetate in the Houston area.

REXALL CHEMICAL CO. is reportedly planning a 25,000,000-lb. per year polystyrene plant, possibly in the Chicago area or the Odessa, Tex., area.

ROHM & HAAS CO., Louisville, Ky., plans to go on stream with facilities to produce adipic acid from cyclohexane late summer 1962. Scientific Design Co., Inc., has contract.

SCHENECTADY VARNISH CO., INC., is scheduled to complete facilities for phenol production at Rotterdam Junction, N. Y., early 1962.

SHAMROCK OIL & GAS CORP., Sunray, Tex., is to complete facilities to produce anhydrous ammonia from natural gas July 1962. Capacity 160 tons per stream day.

SHAWINIGAN CHEMICALS, LTD. (See St. Maurice listing below.)

SHELL CHEMICAL CO. was to go on stream next year at an 80,000,000 lb. per year polyisoprene plant at Marietta, Ohio.

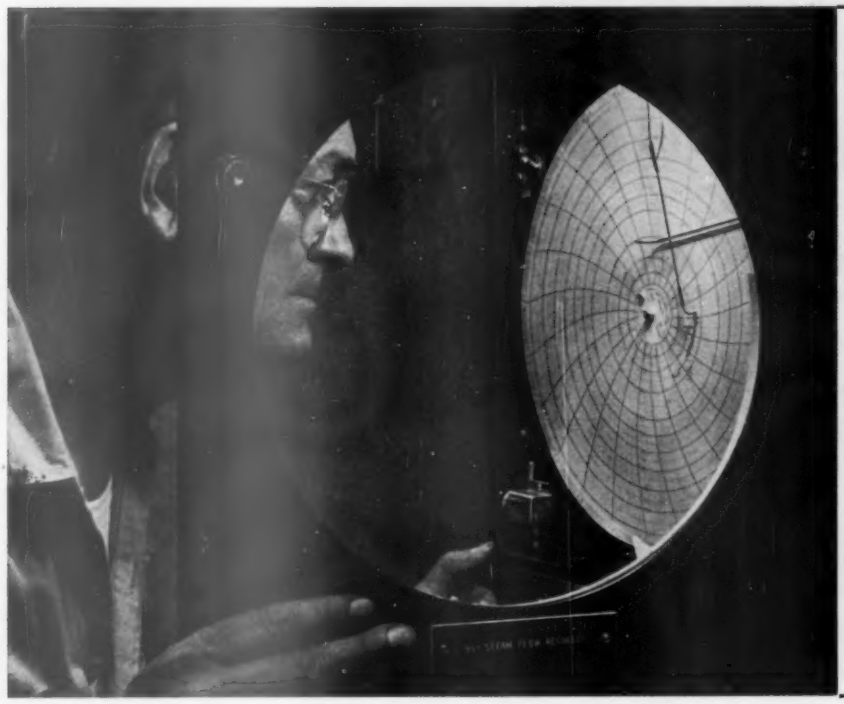
Near Woodbury, N. J., Shell Chemical will complete polypropylene facilities in 1962. Capacity 80,000,000 lb. per year.

SHELL OIL CO. has selected a 3,500-acre site on Delaware Bay below Wilmington and 5 miles from Smyrna for its first East Coast refinery. Long-range plans include a refinery and chemical plant or complex.

SHELL OIL CO. OF CANADA, LTD., was to have sulfur-recovery capacity of about 1,400 long tons per day at a new gas-processing plant in the Waterton-Pincher Creek area of Alberta. Completion end 1961.

SHERWIN-WILLIAMS CO. is raising capacity of its phthalic anhydride facilities to 20,000,000 lb. at Chicago. Naphthalene for the plant is derived from both coal and petroleum, with Ashland and Sun to provide the petroleum naphthalene.

Which of these round chart recorder inking problems do you now have?



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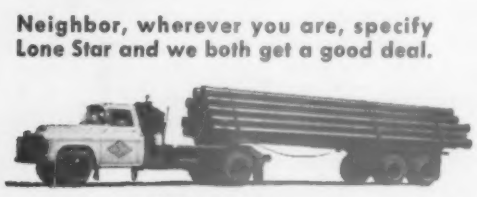

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SKELLY OIL CO. (See Hawkeye listing.)

ST. MAURICE CHEMICALS, Division of Shawinigan Chemicals, Ltd., will build a plant at Varennes, Que., for production of acetaldehyde from ethylene. British American Oil Co., Ltd., will supply the feed stock.

STEPAN CHEMICAL CO. will build a $7-million phthalic anhydride plant in Puerto Rico, using naphthalene to be produced at the Commonwealth refinery at Ponce. Production by Stepan expected to start fourth quarter 1962. Estimated output 40,000,000 lb. per year. Ralph M. Parsons Co. has contract.

SUN OIL CO., Marcus Hook, Pa., will increase high-purity propylene capacity from 120,000,000 to 300,000,000 lb. per year, with completion second quarter 1962. Cost will be about $2.2 million.

At Toledo, Sun was due to complete a 100,000,000-lb. per year naphthalene plant late 1961 at a cost of about $8 million.

SUNOLIN CHEMICAL CO. was due to complete new facilities at North Claymont, Del., late 1961, including capacity for 225,000,000 lb. per year of ethylene and 55,000,000 lb. of ethylene oxide.

SUNTIDE REFINING CO., Corpus Christi, Tex., will complete facilities to produce 60,000,000 lb. per year of styrene from refinery gases spring 1962. Due for completion early 1962 are facilities for paraxylene. Capacity will be 14,000,000 lb. per year.

SWIFT & CO. (See Hawkeye listing.)

TENNECO CHEMICAL CO. is building a 200,000,000-lb. per year vinyl chloride monomer plant on the Houston Ship Channel, with contract awarded to Crawford & Russell, Inc., Stamford, Conn. It is part of a new complex which will also involve facilities for 100,000,000 lb. per year of acteylene and an undisclosed amount of vinyl acetate monomer.

TEXACO INC., Port Arthur, Tex., will build naphthalene facilities with design capacity of 100,000,000 lb. per year and completion by 1963. Due for completion early 1962 are facilities for 30,000,000 gal. per year of benzene.

TEXAS EASTMAN CO., Longview, Tex., will increase polypropylene capacity from present 20,000,000 lb. per year to 30,000,000 lb., with completion last half 1962.

TIDEWATER OIL CO. and **AIR PRODUCTS & CHEMICALS, INC.,** will have capacity for 30,000,000 lb. per year of oxo alcohols at a plant at Delaware City.

TIDEWATER OIL CO. and **COLLIER CARBON & CHEMICAL CORP.** will produce naphthalene at Delaware City following completion of a 100,000,000-lb. per year plant late 1961.

At Los Angeles, Tidewater and Collier will have capacity for 50,000,000 lb. per year of naphthalene.

UNION CARBIDE CHEMICALS CO., Institute, W. Va., will have a capacity of 50,000,000 lb. per year of phthalic anhydride based on petroleum naphthalene following completion of plant in 1962.

UNION TEXAS NATURAL GAS CORP. and **ALLIED CHEMICAL CORP.** recently announced a joint venture involving a $40 to $60-million petrochemical com-

plex near Geismar, La., with construction to start spring 1962 and completion expected mid-1963. Products will include aromatics and olefins up to and including butylene. Plans also call for a naphthalene unit. Feed will consist of 20,000-25,000 bbl. daily of natural-gas liquids.

UNITED CARBON CO., Mojave, Calif., is building a 64,000,000-lb. per year carbon-black plant at cost of $5 million. Completion by Lummus Co. expected by 1962.

U. S. INDUSTRIAL CHEMICALS CO. (For new Houston plant, see National Petro Chemical Corp. listing.)

U. S. PHOSPHORIC PRODUCTS DIVISION (Tennessee Corp.) was to complete a multimillion-dollar ammonia plant late 1961 at Tampa, Fla. Capacity 350 tons per day. Raw material will be natural gas. Chemical Construction Corp. has contract.

WITCO CHEMICAL CO. will have capacity of 30,000,000 lb. per year of phthalic anhydride at Perth Amboy, N. J., on completion of project late 1961. Raw material naphthalene.

WITFIELD CHEMICAL CORP. will have capacity for 30,000,000 lb. per year of detergent alkylate at Watson, Calif., on completion of project late 1961.

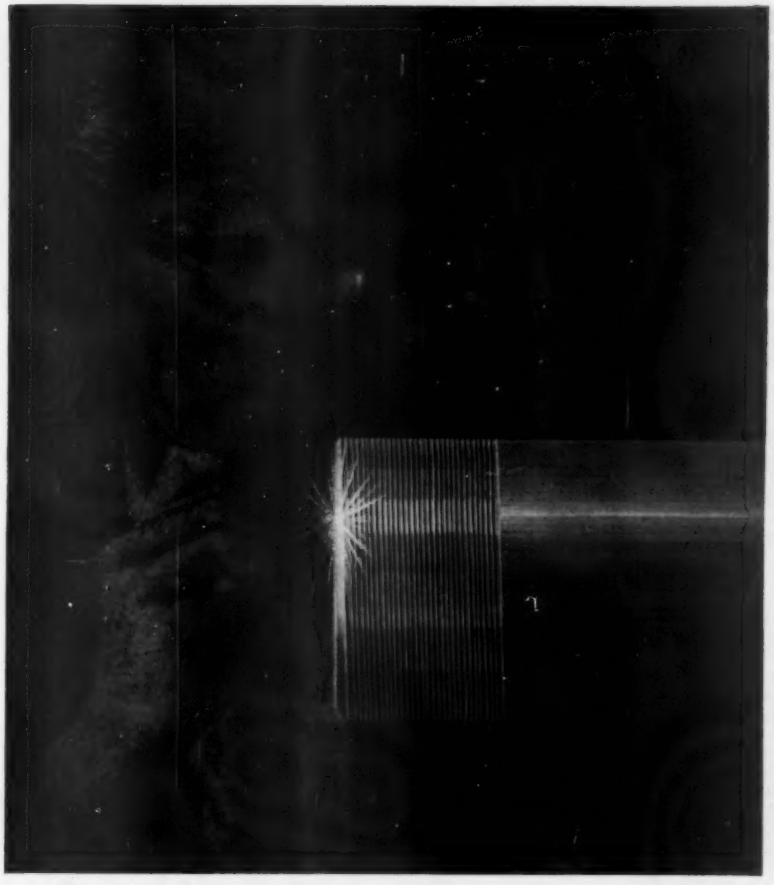
WYANDOTTE CHEMICALS CORP. was to start construction fall 1961 at new $3.5-million plant for propylene oxide at Wyandotte, Mich.

. . . a la carte

Journal's DECEMBER MENU is meaty . . .

THE WEEKLY coverage by The Oil and Gas Journal during the rest of December will include a variety of significant reports, including such enticing topics as:

- How a waste product stream—carbon dioxide—was converted into a profit at a gas-processing operation in California. This will appear in the December 11 issue.
- The use of computers in pipelining. This exclusive 16-page section is scheduled December 18.
- The annual World-Wide Report of December 25. This special issue gives a country-by-country statistical roundup of refining, production, and reserves, plus an analysis of the trends.



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QUESTIONS ON TECHNOLOGY

BY W. L. NELSON, Technical Editor and Petroleum Consultant

Vanadium in California oils

I appreciate your interesting article of December 22, 1958, "Metal Contaminants in Petroleum," but I would like to know the production of the fields in case methods can be found to recover the metals from the oils. Does the amount of contaminant vary throughout a field? C.M.C.

The production (1959) of the important fields can be obtained from pages 162-169 of The Oil and Gas Journal of January 25, 1960. As an illustration, however, Table 1 here shows the productions, gravities, and approximate pounds of vanadium per year contained in some Californian oils. It must be clearly understood that the amounts of metals or gravities reported on particular samples are probably not representative of the entire production of a field. In addition there is always difficulty in knowing which field is meant.

The metal content of the oil from a particular well is usually a quite consistent function of the gravity of the oil being produced.

TABLE 1—VANADIUM CONTAINED IN A FEW CALIFORNIAN PETROLEUMS

	API	1959 production 1,000 B/D.	P.p.m. V	Lb. V per year
Belridge, North	14.0	444	23.0	3,480
Coles Levee	36.2	5,626	11.0	18,330
Cuyama	34.5	12,590	10.0	37,400
Cymric	33.6	2,972	30.0	27,000
Helm	*38.0	878	14.0	3,580
Lompoc	*20.0	357	37.6	2,400
Lost Hills	*23.0	1,274	39.0	16,000
Orcutt	*23.0	975	162.5	50,700
Oxnard	* 9.0	3,206	403.5	441,500
Raisin City	*26.0	1,663	8.0	4,160
Russell Ranch	*35.0	1,951	12.0	6,960
Santa Maria Valley	*15.0	1.954	200.0	132,000
Ventura	*31.0	18,876	49.0	283,000
Tejon Hills	24.9	495	64.0	10,000
Wheeler Ridge	*35.0	2,040	7.0	4,230
Wilmington	15-29	26,974	42.0	364,000
				1,406,740

*Estimated gravity.

How does Russia compare?

In your issue of November 28, 1960, you do not mention Russia. How do its refineries compare with those in the free world? R.V.S.

The USSR was not mentioned in Process Costimating No. 84, November 28, 1960, p. 80, because the process composition and even the capacity of USSR plants can only be surmised. According to Information Circular No. 8023 by Donald J. Frandzel, USBM (1961) the demands and refinery outputs in 1958 and 1967 indicate the need of the following approximate processing capacities when operating on about 31° API crude oil (27° API in 1967):

	1958	1967
Crude distillation	100	100
Cracking	13	25
Reforming	1	8
Viscosity breaking	3	18
Asphalt manufacture	3	3.1
Vacuum flash	...	10
Light oil treating	64	63
Polymerization or alkylation	0.2	0.7
Desulfurization	...	3
Specialties	1	1
Lube manufacture	3.9	3.8

These are quite simple refineries (about 2.2 and 4.0 complexity in 1967) except for lube manufacture which is so complicated that it raises the complexity to about 3.85 (1958) and 5.54 (1967) when using a factor of only 45 for the complexity of lube manufacture in Russia. Complexity was explained in June 19, 1961, p. 109, issue of this page. The 7-year plan (Information Circ. 8023) contemplates the construction of 120,000-bbl. per day standard fuel-type refineries which have a complexity of about 4.44 (28.4% catalytic cracking, 16.7% catalytic reforming and 28.4% viscosity-breaking capacity).

Such processing capacities are also reasonable in terms of clear motor method octane numbers which have been mentioned for Russia:

1958 about 64
1963 about 75
1965 about 82

These complexities compare with refineries throughout the world as indicated in Table 1.

Table 1—Complexity of Refineries Throughout the World* (1958)

Region	Approx. complexity
USSR	3.85
South America†	3.5
Middle East	3.4
Far East	2.9
Europe	4.68
Canada	6.35
U.S.A.	7.63

*Primarily from Process Costimating No. 84, The Oil and Gas Journal, November 28, 1960, p. 80.
†Primarily Caribbean area.

Petroleum-coke hardness

What is the meaning of the term "hardness" used in your "Petroleum Refinery Engineering" with respect to the properties of petroleum coke? N. S.

The hardness of coke was discussed briefly on the Questions on Technology page of November 28, 1955, pp. 117 and 118. Two methods used in stating the hardness of coke have been (1) ASTM shatter test, and (2) a so-called friability test (arbitrary units). The ASTM shatter test is based on the percentage of 2-in. lumps that can survive the test. It is related to volatile matter somewhat as follows:

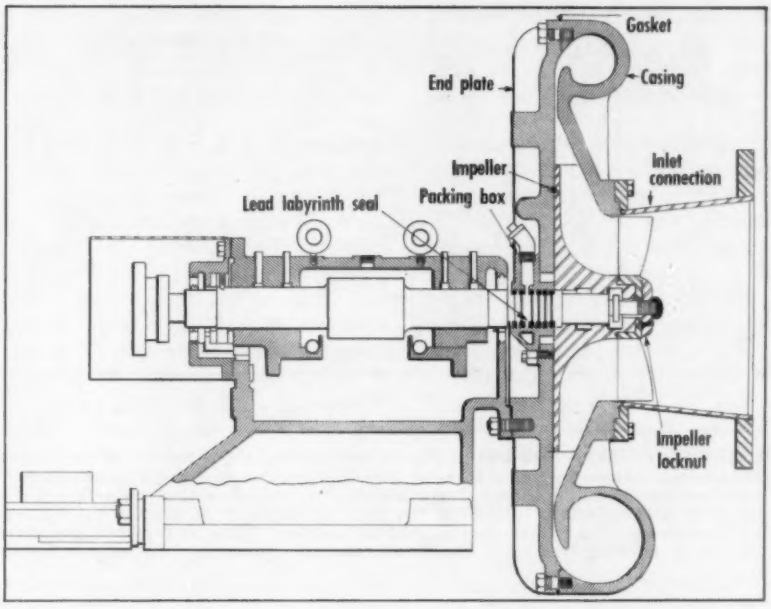
Volatile matter (%)	Percentage of 2-in. lumps remaining
14-18	none
8-10	83 (74-93)
2.1	91 (89-93)

Most petroleum coke is not strong enough for use in foundry cupolas. By further processing of the coke in gas retorts (calcining) to a volatile matter of 2.1%, it is possible to produce cupola coke of satisfactory strength. Some of those who have mentioned or discussed the hardness of petroleum coke are:

1. Berry, A. G. V. and Edgeworth-Johnstone, R., Ind. Eng. Chem., 36, 1140 (1944).
2. Carpenter, C. B., Mechanical Engineering, 56, 330 (1934).
3. Diwoky, R. J., The Oil and Gas Journal, 37, No. 27, 131 (1938).
4. Morrell, J. C., and Egloff, G., Chemistry and Industry, 51, 467 (1932).
5. Thomas, Thos. L., Progress in Pet. Technology, a publication from the September 1951 New York meeting of American Chemical Society.

Although the various fluid cokes are of higher strength than the cokes produced by the delayed process, no way has been devised (to the knowledge of this department) to consolidate the fluid coke into lumps that are hard enough to be used for cupolas. The volatile matter in fluid coke ranges from 3.5-5.3%.

IMPORTANCE of proper metallic materials of construction selection is shown in this single-stage compressor handling wet SO_2. Normal materials deteriorate almost visibly in this duty. The above compressor was built using Carpenter-20, 20% chromium, 30% nickel stainless alloy for all components in contact with the gas. This has been an outstandingly successful installation, with virtually no corrosion damage appearing after 4 years of almost continuous operation.



BY WALTER A. SNOW
Elliott Co., Jeannette, Pa.

How centrifugal compressors work with industrial gases

Here's a rundown on their application to gases other than air, and some long-range forecasts which appear valid

CENTRIFUGAL compressors for air-handling service have been in use for many years. These have proven to be fairly simple, rugged, long-life units. Only in recent years has the use of centrifugal compressors on industrial gases other than air become widespread. But accompanying these other uses have been problems which are peculiar to the type of service involved and which have required design differences from air applications.

The use of centrifugal compressors on industrial gases other than air is so varied today that it is difficult to categorize them concisely. However, in a general way, there are seven broad areas of application. These are:

1. Industrial refrigeration. The problems here are those associated with the handling of gases at temperatures down to about —200° F., sealing to prevent gas leakage, handling more than one pressure, and temperature level of refrigeration by the use of side streams.

2. Hydrogen reforming. The problems here are those associated with the handling of light gases, essentially hydrogen in composition, at elevated pressures. Mechanical construction for safety considerations and gas sealing are most important.

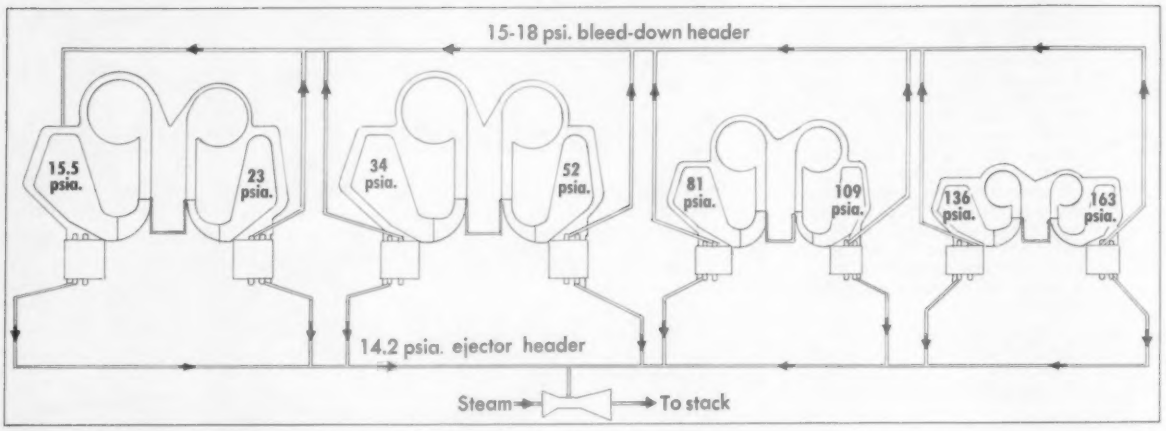
3. Various feed-gas, off-gas, or wet-gas streams. This is a broad category. Often such gases are saturated with water or hydrocarbons or both, and may contain traces of sour-gas contaminates. Corrosion, polymerization, and gas sealing are all problems.

4. Pipeline compression. These compressors are usually special-purpose units. The problems are primarily those of handling natural gas at high pressures. Performance and sealing are important.

5. Lethal or otherwise toxic chemical gases. Gases such as chlorine, boron trichloride, phosgene, or other similar compositions come under this category. The problems here usually involve corrosion, Mach number limitations, and gas sealing.

6. Coke-oven gases. The major problems here are usually those of gas sealing and condensation of coal tars on the compressor internals.

Adapted from "Applications of Centrifugal Compressors to Industrial Gases," presented at the ASME process industries conference, Houston.



A BLEEDDOWN ARRANGEMENT of high-pressure process gas back to some low-pressure points such as the suction of the machine is only one of the many types of dry seals used on centrifugal compressors. This arrangement for a multiple-compressor acetylene application is shown. There are eight points of sealing in this four-machine train which lifts acetylene-laden natural gas from atmospheric to 190 psia. The total recirculation of process gas requires approximately a 2% increase in compressor horsepower. The effluent lost to stack is less than 0.3% of the throughput flow. The power loss for this system is less than twice that required for a liquid seal, and all complications of a liquid system are eliminated.

7. Oxygen compression. Since many metals will burn in a sufficiently enriched oxygen atmosphere, the main problems here are those of sealing, proper materials of construction, and safety.

Many of the same features apply to more than one of the above applications. Therefore, to describe compressors by application types would result in unnecessary duplication. It is simpler to generalize such descriptions to aspects relating to materials of construction, design, corrosion, safety, and performance, respectively. Special problems of any of these categories relating to particular applications may then be easily noted.

Materials of Construction

The versatility of the centrifugal compressor often permits the use of the same materials of construction on gases as those used for air services. There are, however, some important exceptions. Accompanying is a tabulation of typical materials of construction used for the above compressor applications, plus air. These categories are so broad that it is impossible to be sure that any given material will always be used. Thus, the compositions tabulated must be considered as typical rather than exact. Some of the reasons for choosing these materials for particular components are outlined below:

Main casings. Compressor main casings are normally either of the horizontal or vertical split (barrel) type. For normal temperatures and operating pressures below about 600 psi., a horizontal split arrangement is normally preferable for ease of assembly and disassembly. Most such casings are castings. Sometimes, however, fabricated casings are used, particularly on special applications where the cost of a pattern cannot be justified.

For temperature service limits between —20° and 650° F., either gray cast iron, ductile cast iron, or medium cast steel is usually employed. The engineering choice among these three is mainly one of stress limitation. Although compressors are not ASME core vessels, the stress levels permitted are usually based upon the ASME Unfired Pressure Vessel Code limitations.

Fabricated casings are normally composed of low or medium carbon-steel plate. Since most such cases involve welding, a flange-quality weldable grade of steel, such as ASME SA-285, Grade C, is required. The permissible stress limitations on this type of material and construction are the same as those on carbon cast steel.

Vertically split-type casings normally employ forged medium carbon steel, such as ASTM A-266, Class 1 or 2. This specification has about the same physical properties and stress limitations as those listed above for cast or fabricated carbon steel.

Diaphragms, bearing casings, etc. Diaphragms, in most applications, are made from ordinary gray cast iron of ASTM A-48, Class 30. Code restrictions are not applicable to such components.

On oxygen compressor with semi-open impellers where rubbing may occur between the impeller vane and a contoured diaphragm, aluminum bronze may be used rather than cast iron, since it will withstand local heating with less danger of cracking and is nonsparking.

Bearing and seal housings are similarly made from medium-strength cast iron unless they act as a part of the pressure-containing envelope. In the latter case they usually match the main casing in chemical and physical properties and are subject to the same stress and temperature limitations.

Rotating elements. A standard material for shafts, impellers, shaft sleeves, thrust disks, etc., is AISI 4130 or 4140 low-alloy steel. This material is highly satisfactory for operating temperatures from —100° to 650° F., in normal or slightly corrosive service. Alloy-steel shafts are normally supplied for gas compressors. However, there are applications, particularly on large machines, where plain carbon-steel shafting is preferable, even though it possesses considerably lower physical properties.

For sections 2 in. or greater in thickness, where high yield strength is required, an alloy with better deep section hardenability, such as AISI 4340, is preferred.

Seals and labyrinths. For economic reasons, most compressor labyrinths are made from either

sand or centrifugally cast aluminum. Aluminum is usually acceptable in most industrial gas atmospheres, has excellent abrasion resistance, and is economical in cost. It does, however, have the following drawbacks and limitations:

1. It starts to lose physical properties above 300° F. and probably should not be used as a labyrinth material above about 500° F.

2. Because of its high coefficient of expansion, it grows considerably more than adjacent housings. Thus, to prevent split line gapping at operating temperature, allowance must be made for this difference in expansion.

3. Aluminum is not suitable in some services, such as chlorine, etc., because of corrosion-resistant limitations.

Bearings and bushings. The usual material for compressor journal bearings and thrust-bearing shoes is steel-backed babbitt. Several babbitt compositions are available which are satisfactory. The important criterion here is to use a tin-based rather than a lead-based alloy. The monels, the ferritic stainless, and the austenitic stainlesses should be avoided.

Elastomers and sealants. Elastomers are being increasingly used in modern compression applications, both as static and sliding seals. The most usual form of such materials is as O-ring or as liquid or solid gaskets at flanged joints.

Buna N is the most commonly used O-ring material in centrifugal compressors. For most gases normally handled, it has excellent corrosion resistance and is inexpensive and durable, for both sliding and static fits, provided it is not subjected to temperatures above about 250° F.

The silicone rubbers possess excellent characteristics as static seals. They are inert in almost all atmospheres including oxygen, retain fair elasticity up to about 350° F., and with the recent introduction of satisfactory bonding cements are now a very practical elastomer.

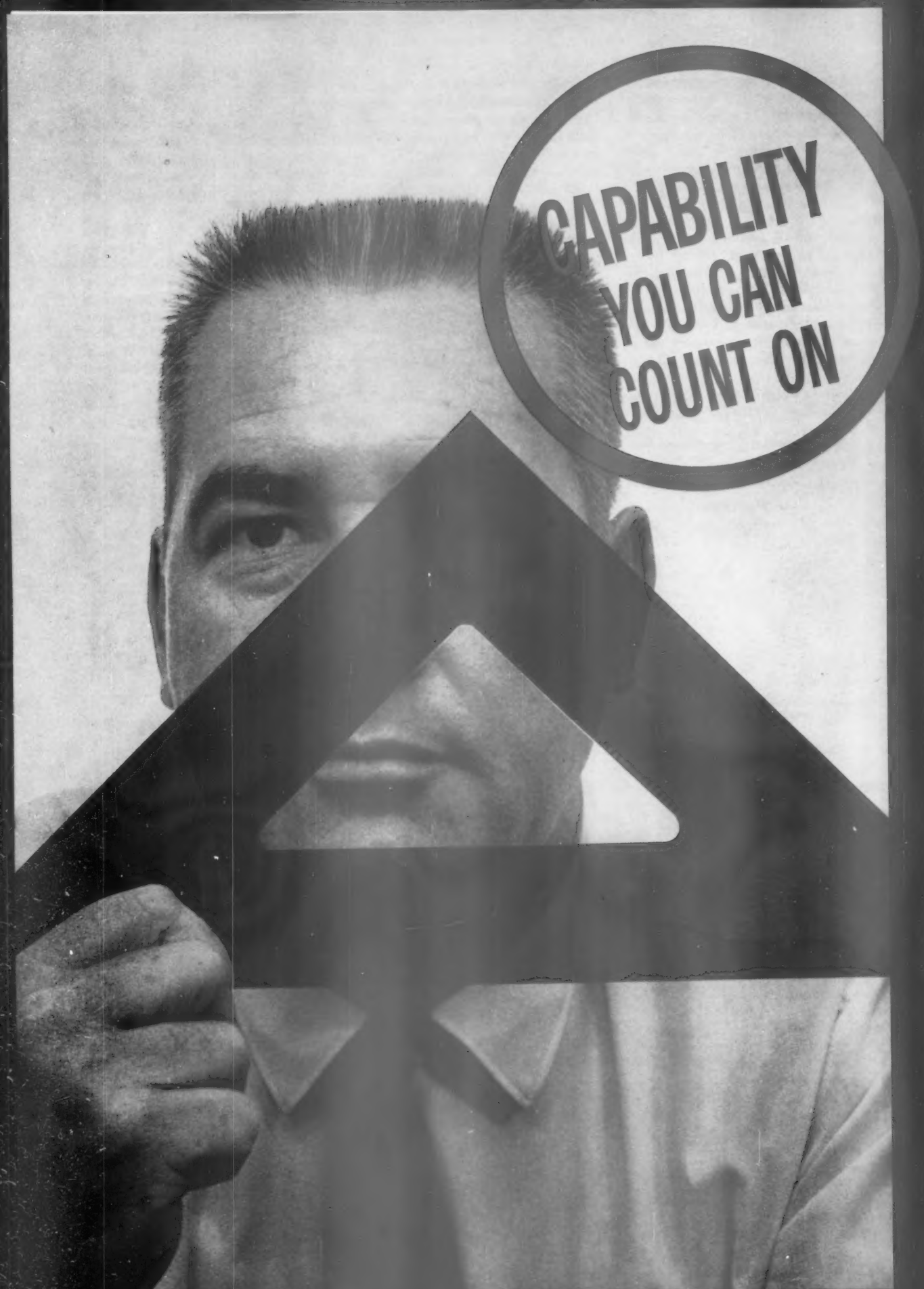
Viton A, a Du Pont polyester, appears to have the most promising all-around characteristics of any of the presently available O-ring elastomers. It is inert in practically all atmospheres including oxygen, retains fair elastic characteristics from —40° to about 350° F., and has abrasion resistance at least equal to buna N. Unfortunately, it is by far the most expensive of any of the available compounds.

Design

Many design details employed in air-compressor applications have

Typical construction materials for industrial centrifugal compressors

Component	SERVICE						
	Air	Refrigeration at —175° F.	Hydrogen reforming	Wet gas	Pipeline	Lethal or toxic gas	Oxygen
Main casing	Cast iron ASTM A-48 Cl 40	Cast Ni-steel 4½% Ni	Forged steel ASTM A-266	Cast iron ASTM A-48 Cl 40 or cast steel ASTM A-216 Gr WCB	Cast steel ASTM A-216 Gr WCB	Cast iron ASTM A-48 Cl 40 or stainless steel	Cast iron ASTM A-48 Cl 40 or 12 chrome AISI 410
Diaphragms	Cast iron ASTM A-48 Cl 30	Cast Ni-iron Cl 40	Cast iron ASTM A-48 Cl 30	Cast iron ASTM A-48 Cl 30	Cast iron ASTM A-48 Cl 30	Cast iron ASTM A-48 Cl 30	Cast iron ASTM A-48 Cl 30 or Al. Bronze ASTM B-148 Cl 9-A
Rotating elements-impellers	AISI 4130 or 4140	AISI 2340	AISI 4130	AISI 4130 or 4140	AISI 4130 or 4140	AISI 4130 or high-str. stainless alloy	Armco 17-4 pH
Shaft	Carbon steel AISI 1040 or AISI 4140	AISI 2340	AISI 4130	AISI 4130	AISI 4130	AISI 4130	Armco 17-4 pH
Journal bearings	Tin-based babbitt ASTM B-23 Class 2	Tin-based babbitt ASTM B-23 Class 2	Tin-based babbitt ASTM B-23 Class 2	Tin-based babbitt ASTM B-23 Class 2	Tin-based babbitt ASTM B-23 Class 2	Tin-based babbitt ASTM B-23 Class 2	Cloth reinforced phenolic resin on hardened 17-4 pH sleeves
Thrust bearing	Kingsbury type with babbitt shoe on oil-hardened disk	Kingsbury type with babbitt shoe on oil-hardened disk	Kingsbury type with babbitt shoe on oil-hardened disk	Kingsbury type with babbitt shoe on oil-hardened disk	Kingsbury type with babbitt shoe on oil-hardened disk	Kingsbury type with babbitt shoe on oil-hardened disk	Kingsbury type with phenolic resin shoe on hardened 17-4 pH disk
Labyrinths	Aluminum	Aluminum	Aluminum	Aluminum, bronze, Teflon	Aluminum	Aluminum, bronze, Teflon	Aluminum bronze
Type shaft seal	Labyrinth	Oil	Oil	Oil or labyrinth with sweet gas injection	Oil	Buffered oil, labyrinth with sweet gas injection, or dry carbon ring	Breakdown labyrinth with traps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also been successfully adapted for gas machines. This is particularly true for relatively standard features which were first developed for air and later very successfully extended to gas.

Main casings. Gas - compressor main casings are inherently similar in construction to air machines for comparable pressure levels and temperatures. One major difference is the provision of side nozzles for intermediate injection or extraction of sizable percentages of the throughput flow. On refrigeration cycles, this ability is particularly important since intermediate pressure or temperature operating levels are often desirable.

Seals. One of the most important differences between air and gas compressors is in the area of sealing. Air compressors usually employ simple labyrinth seals, whereas most gas units require some positive sealing system to prevent the gas from leaking outside the compressor. Either gas or liquid sealants are used. For the former, sweet gas is often injected between the process gas and the atmosphere and permitted to leak both into the gas stream and the atmosphere. If this is unacceptable, a mixture of seal gas and process gas can be pulled off and fed to a removal point, such as a tower flare, scrubber, etc.

The most common sealing medium used in hydrocarbon compressors is a liquid. Normally, a light-viscosity lubricating oil, preferably the same oil as used on the compressor lube system, is injected under pressure in an isolation chamber between the process stream and the bearing chamber. Seals of this type have been successfully applied at operating pressures of many hundred pounds per square inch.

Thrust loadings. During the past 3 or 4 years, there have been an abnormal number of thrust-bearing failures on process gas centrifugal compressors. Because of the seriousness of this problem, Elliott initiated a program to learn more about how axial thrust is generated in a centrifugal compressor stage. This program was largely experimental and was divided into three parts. First, the pressure distribution around typical impellers at various operating conditions was measured. Second, equipment was developed to permit measurement of the force exerted on the thrust bearing of a multistage compressor. Finally, some tests were run to evaluate the durability of conventional thrust bearings.

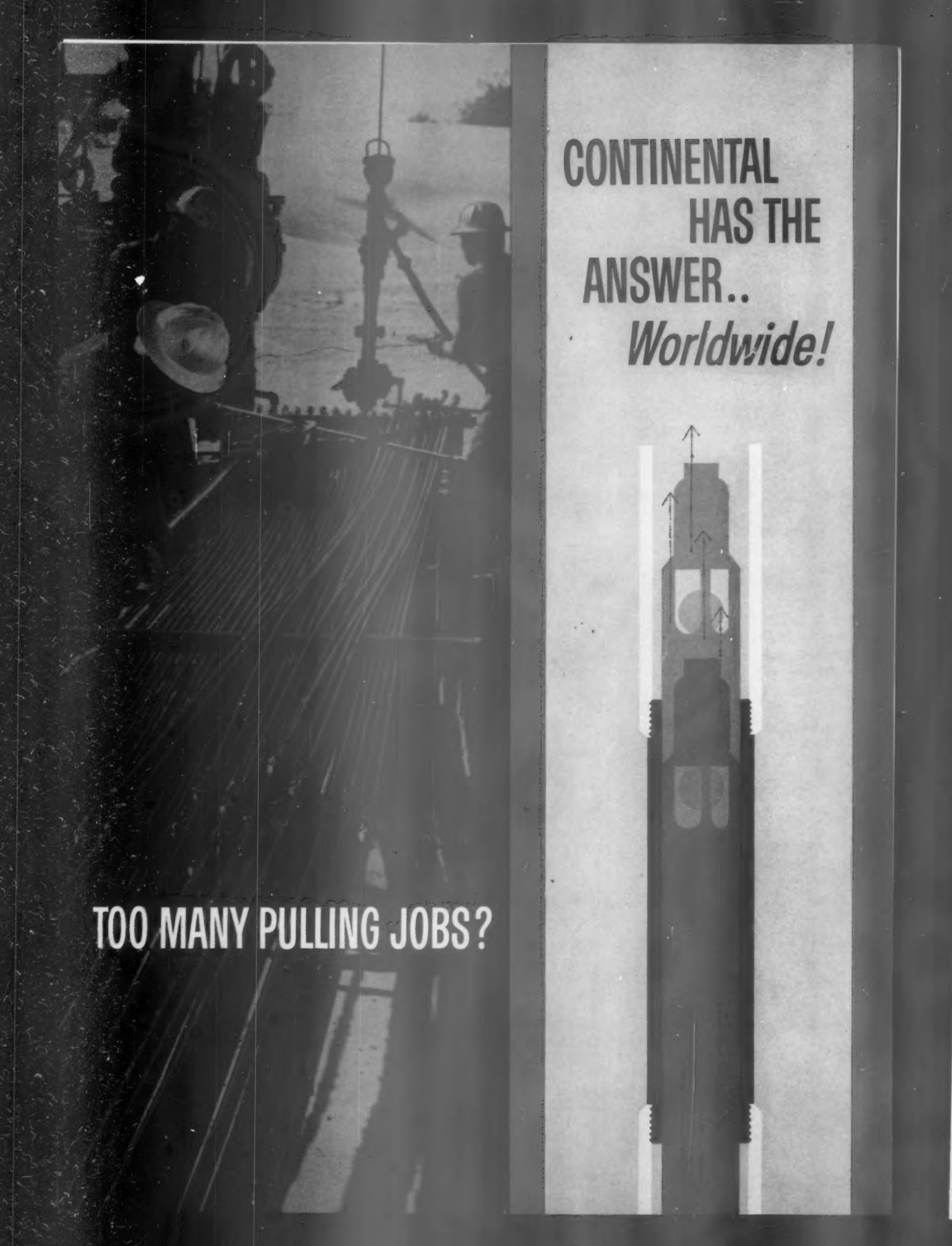
As a result of these studies, a maximum allowable permissible design value thrust loading of 400 psi. has been set. Thrust bearings operating at this load should last forever.

Water lubrication. One of the more touchy applications for centrifugal compressors has been the handling of gaseous oxygen. Since more and more industries are becoming dependent upon high-purity oxygen for process economy, this application is becoming very important. The primary problem in oxygen compressors has been their tendency to catch on fire and burn up with large resultant damage. The most common cause of such self-ignition is the presence of hydrocarbons in the oxygen stream due to contamination from the atmosphere or from the lubricating-oil system.

Some years ago, Elliott decided to take a radical approach to the problem of oxygen compressors. First it was decided to make the amount of material in contact with the oxygen as small as possible; thus, high head stages were selected. Second, all the internal materials of construction were selected to be completely noncombustible in the presence of high-pressure oxygen. Last, it was decided to eliminate conventional lubricants, so that there could be no possibility of contamination which might start a fire. This final decision meant that water or gas was required as a lubricant. Water lubrication was selected.

The water - lubricated bearings which were developed have rubbing surfaces made of a laminated-cloth phenolic resin bonded to a steel liner or thrust shoe, running against a mating surface of hardened 17-4 pH alloy as a journal or thrust runner. This combination has given excellent service and is considered to be completely satisfactory for such duty. The bearings are not exposed to high pressure but are surrounded by oxygen and water at suction pressure. The phenolic resin will char but not burn in the low-pressure oxygen environment even though complete failure of the lubricating system occurs.

Tip speeds. Radial-vaned impellers are already running at tip speeds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up to 1,350 ft. per second. In addition, with the improvement of welding techniques, designs, etc., backward - leaning vaned - impeller tip speeds have been rising steadily during recent years. Elliott is now offering maximum continuous operating tip speeds of 900 ft. per second for many backward-leaning vaned - impeller applications. However, not all process-gas applications are suitable for 900-ft. per second staging.

Compressor performance is primarily a function of geometry and Mach number. Thus, on relatively high-mole-weight gases, such as propane, isobutane, chlorine, etc., Mach-number limitations rather than mechanical stresses must be considered as a limiting factor for impeller-tip speed. On lighter gases, such as methane and process streams containing a sizable fraction of hydrogen, this higher permissible tip speed has real merit in reducing the number of stages required for a given head rise.

Corrosion

Corrosion can be a real problem on some compressor services, but it is usually minimized by special materials of construction or operating techniques. Chlorine, for instance, is very corrosive when wet, but can be handled fairly easily if kept dry and cool.

A different aspect of corrosion is the combination of erosion-corrosion which occurs when liquid entrainment is present. A good example of this kind of attack was found on a shaft sleeve and impeller in a butadiene compressor using water injection for cooling. Low - alloy steel was used in both components, and severe damage occurred in about a year's service. At first, it was thought that erosion was the culprit. However, the same materials had successfully been used in other installations involving liquid injection. Thus, a check on the corrosion possibilities was made. It was found that the injection water was quite acid with a pH of about 4.6. When this was corrected and small amounts of ammonia were introduced into the cycle to keep the gas a neutral pH, the erosion-corrosion problem substantially disappeared.

An interesting example of a "safe" material proving to be relatively unsuitable was found in one of the early hydrogen reforming compressors using a K monel impeller. When the first such units were ordered, most users specified monel rotors. It was believed that this would provide an unusually durable and long-life material. To obtain the required strength, it was necessary to use K monel. After some of these impellers had been in service for a short time, a number of impeller failures occurred, almost surely because of hydrogen embrittlement of the material. The exact cause of this phenomenon has never been completely resolved. It appears to be tied up with the presence of certain chlorides and sulfides in the gas stream.

By proper washing techniques prior to removal from the gas stream and dismantling, the problem has been essentially corrected. However, similar machines using standard low - alloy carbon - steel impellers have never incurred this type of failure.

Use of special metals to overcome corrision is sometimes so expensive that it is more economical to use conventional materials, such as cast iron, carbon steel, low-alloy steel, etc., and coat them to protect the parts from corrosion.

Safety

Along with all of the other requirements imposed on centrifugal compressors, the manufacturer and the user must always be alert to the results of their selections in design, materials of construction, etc., from the viewpoint of the safety of the surrounding environs and operating personnel. This is particularly true on most process-gas applications. Thus, proper selection of materials of construction for pressure-bearing components from a stress and corrosion viewpoint, provision for possible power or auxiliary-equipment failures, proper warning equipment, such as temperature or thrust-measuring devices, automatic shutdown hookups, special design and material selections for applications such as oxygen compressors must all be considered from the safety viewpoint.

Also related to compressor safety is noise. While this does not normally affect the machine behavior, it is of increasing concern to compressor users because of personnel problems.

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Performance

Performance of gas compressors, in general, offers few problems different from air applications. The laws of aerodynamic behavior hold in either case, provided the same regions of Mach number, Reynolds number, flow coefficient, etc. are used. Sheets[3], Weisner[4], Davis, et al.[5], Macaluso[6], O'Neill et al.[7], and others have presented voluminous evidence that aerodynamic behavior can be generalized for all gases if proper correlations are used.

A phenomenon in the behavior of centrifugal compressors which usually occurs only on applications involving gases with relatively high mole weight is that of reaching choke flow conditions in the impeller eye. When the local relative stream Mach number at the impeller throat approaches unity, no more flow can be induced through the compressor regardless of downstream conditions. This phenomenon is described in some detail by Lown and Weisner[8].

One problem which can arise in some nonideal gas applications is the determination of the thermodynamic behavior of the gas itself. There is no exact way to compute nonideal gas behavior during compression, other than to construct Mollier chart relationships. For pure substances, this information is often available.

For mixtures, unfortunately, exact information is not often available, and approximate techniques must be used. Simplest of these is the so-called "n" method, where the specific heat ratio of the gas is determined from the laws of thermodynamic relationships for mixtures.

Better methods for handling these types of situations have been studied for several years. Edmister[9, 10], York[11], etc. have presented a number of papers relating to this subject. A recent and very comprehensive treatment is that of Schultz[12].

Conclusion

There are several long-range forecasts which appear valid for industrial applications of centrifugal compressors. These are:

1. The average capacity of gas compressors will increase as process streams continue to grow.

2. More high-pressure installations will occur in proportion to the total units running.

3. More specialized types of centrifugal compressors either for corrosive applications or for applications requiring special precautions, such as oxygen compressors, will be designed and used.

4. High-speed designs and techniques, such as radial high head impellers, vaned diffusers, etc. will be increasingly adapted for gas-compression applications.

5. Performance will be a more and more important aspect in gas compressors as has already happened in the case of air machines.

6. Centrifugal compressors in new more advanced, more efficient, and somewhat larger forms will continue to play an important role in the handling of industrial gases for a long time.

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Open-mindedness demanded by the petroleum industry today appears in many forms. But one of the topics that is most controversial is the slim-hole completion.

- Engineers are thinking how slim-hole completions will save money.
- Bank loan officers are thinking of the payout period.
- Manufacturers are wondering what new tools can be developed to meet the demands.
- Drilling contractors are wondering how they can benefit. And so it goes. . .

. . . But what's holding back the "tubing-for-casing" method?

—asks this author

BY PHILIP L. McLAUGHLIN
President, McLaughlin Co., Dallas

ONE OF the principal deterrents to slim-hole completions is fear of the unknown. This happens with any new concept at its inception. In many cases, drilling, evaluation, and completion are well within the realm of operational suitability. But what is not known, and far from being accepted, is the success, or lack of success, in workover operations. Future workovers may hold the key to the payout and economic success of wells completed as "tubing-for-casing" completions.

Reluctance to accept this risk until it has been resolved is only human; but the need to accept risks and "be right" may only permit corporate survival. Consequently, the luxury of procrastination may be fatal. Therefore, "evaluative thinking" must be realistic. Where the "tubing-for-casing" method is successfully practiced by the competition, little or no choice remains.

Other operators of greater conservatism would express additional doubts grading into fear on other items, with some few operators condemning completely the entire concept of tubing-for-casing completion.

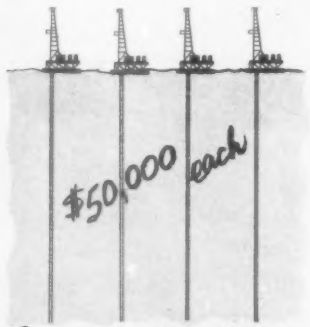
Successful workovers common. The fact that a substantial degree of success in workovers has already been demonstrated suggests that this, like the conversion of the buggy to the automobile, may be another step in progress.

The economy of tubing-for-casing completion is quoted at various values, depending upon who does the figuring, the basis upon which his computations are made, the depth, area, and other factors.

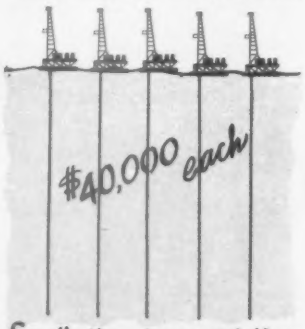
Example. Assume an operator has a choice of investing $200,000 for development wells in either conventional or tubing-for-casing completions. Assume a cost of $50,000 for a conventional completion. In this case, he will end up with four wells.

If tubing - for - casing wells cost only $40,000, he will end up with five wells.

Further assume a produced allowable of 50 bbl. of oil per pro-

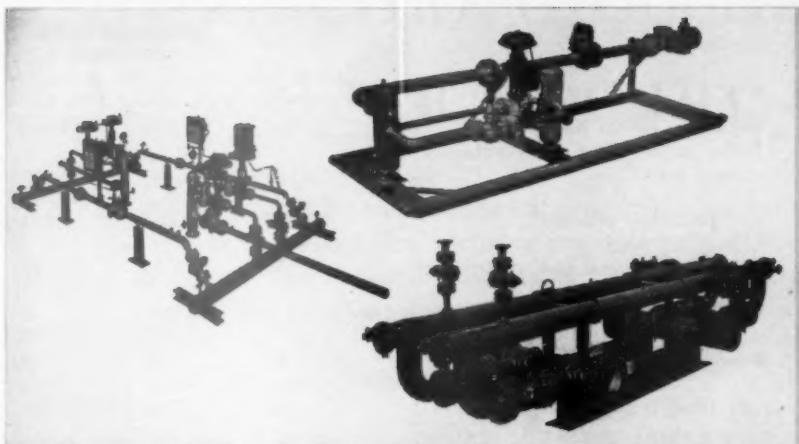


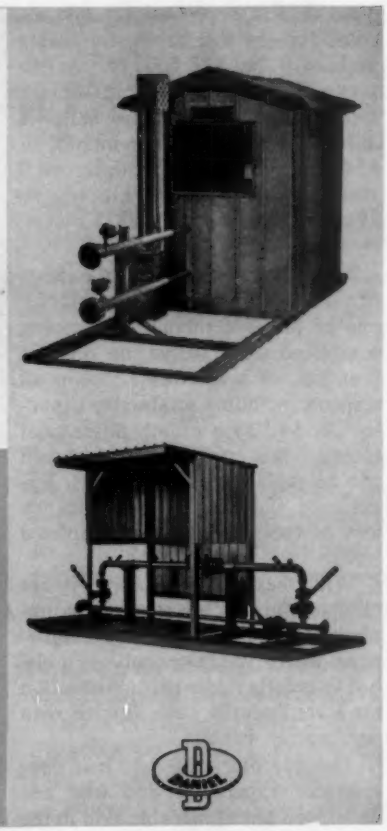
Conventional completions



Small-diameter completions

Which for your $200,000—four wells at $50,000 each, or five at $40,000?





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duced calendar day per well at a price of $3.00 per barrel. The income for the five tubing-for-casing wells will be $22,500 per month versus $18,000 per month for the conventionally completed wells—a difference of $4,500 per month, or $54,000 per year. This differential yearly income of $54,000 represents 27% of the base $200,000 investment.

Further, in respect to the fears of the ultraconservative operator, if one of the five tubing - for - casing completed wells is lost, he still has four left, or a number equal in all respects including productive capacity. At $4,500 a month differential income, this tubing-for-casing well can be replaced in 8.9 months. Experience shows no such frequency loss of tubing-for-casing completed wells.

With these facts in mind, it not only encourages an operator to implement tubing-for-casing completions where fundamentally suitable, but to quietly retain this information on a confidential basis for his own competitive benefits.

The operator who has had considerable experience and who has developed knowledgeable skill in the use of tubing - for - casing completions, will be the first to admit that new and different problems arise, the first to claim the need for different solutions, the first to exercise selectivity in wells for tubing-for-casing application—and the first to realize rewards in savings.

Investor viewpoint. The relationship between intangible and tangible dollars can be improved by using tubing-for-casing techniques. From the hypothetical data in Table 1 it can be seen that it is possible to hold down the tangible dollar investment by using the tubing-for-casing techniques. Since the tax treatment of the tangible dollar is different from that of the intangible dollar, it is possible to tie up less money in capital items by the slim-hole method. This is very important now due to our high cost of capital.

Assume an individual investor in the high tax bracket is presented an intelligent program allowing him to wisely invest his pretax income with an operator who uses slim-hole and tubing-for-casing techniques. A greater proportion of each invested dollar would be immediately deductible for income-tax purposes. Slim - hole - completion techniques reduce the capital investment to be recovered through depreciation of the life of the property.

Table 1—Single tubing-for-casing program

	Conventional completion	Tubing-for-casing completion	
		20% saving	25% saving
Deductible for tax purposes (drilling cost)	14,000	14,000	14,000
To be capitalized for tax purposes (equipment cost)	6,000	4,800	3,900
Total (cost of well)	20,000	18,800	17,900
Percentage of total cost (capitalized)	30	26	22
Percentage of total cost—deductible for tax purposes	70	74	78
Recoverable through depreciation	30	26	22
Total	100	100	100

Savings, after taxes, effected through slim - hole and tubing - for-casing techniques make funds available for further exploration and drilling activity.

Any intelligent discussion of economics governing the oil industry would not be complete without discussing the law of oil-property depletion rate.

This law states that 27½% of the gross income from the properties (oil and gas sales) may be set aside each year and that amount may not exceed 50% of the net income of the property.

The following cases show how this law works:

Case No. 1

Oil and gas sales for the year (gross income)	$100,000
Expenses and charges:	
Lease operating expense	$20,000
Development cost	20,000
Overhead expense	5,000
Depreciation charges	20,000
Total	$65,000

$100,000 − $65,000 = $35,000 (net yearly income).

27½% of $100,000 = $27,500.

50% of net income ($35,000) = $17,500.

The law says 27½% of the gross income or 50% of the net income, whichever is smaller, would be the percentage of depletion. Therefore, in Case No. 1, the percentage depletion would be $17,500. It might be appropriate to point out that in this example any reduction in the depreciation charges, development costs, operating expense, or overhead would increase the percentage depletion.

Case No. 2

Oil and gas sales (gross income yearly)	$100,000
Expenses and charges:	
Lease operating expense	$20,000
Depreciation charges	15,000
Development cost	
Overhead expense	4,000
Total	$39,000

$100,000 − $39,000 = $61,000 (net yearly income).

27½% of $100,000 = $27,500.

50% of net income ($61,000) = $30,500.

Therefore, the depletion allowance would be $27,500 in this case.

Payout on slim-hole completions. A well pays out when it returns its original cost with a proper rate of interest on invested capital plus the cost of operating the well during the payout period. It follows that anything that can be done to reduce well costs will accelerate the payout of the well. Slim-hole and tubing-for - casing completion techniques offer an opportunity to reduce the original well cost.

In shallow singly completed wells, the completion cost will generally exceed all other costs. As the wells

to waterflood operators who do not fracture wells

A few operators are still afraid to fracture waterflood injection and producing wells in spite of the fact that fracturing programs for waterflood projects are widely accepted. Here are some questions frequently brought up by these operators. The answers are based on records of thousands of treatments performed by Dowell.

QUESTION:

Will fracturing hasten breakthrough between injection and producing wells?

ANSWER:

Generally speaking, *no!* A poorly-designed fracture treatment of a producing well — performed too early in the life of a flood — can hasten breakthrough. In practice, however, this seldom happens.

Normally, breakthrough has been either unaffected or actually retarded by Dowell-engineered fracture treatments that were performed at the correct time.

QUESTION:

Will a premature breakthrough reduce ultimate economic recovery?

ANSWER:

If breakthrough does occur between an injection and a producing well, loss can usually be avoided by an appropriate change in the well pattern.

Dowell-engineered fracturing, however, has generally reduced, rather than increased, premature breakthrough.

QUESTION:

Will breakthrough to formation water reduce economic recovery?

ANSWER:

Loss can usually be avoided by changing the pattern of producing wells and injection wells. If formation water is likely to be a problem, however, Dowell engineers often design treatments to avoid breakthrough.

QUESTION:

Will fracturing affect water/oil ratios?

ANSWER:

Not in a consistent manner. Water/oil ratios may be increased, unchanged or reduced by fracturing. This is usually unimportant, however, since a waterflood that has been fractured should accommodate a higher water cut economically than one that is operated without fracturing. Dowell engineers design treatments on waterflood wells to avoid excessive water production.

QUESTION:

Will fracturing increase water handling costs?

ANSWER:

Fracturing programs have generally *reduced* water handling costs per barrel of oil produced. The daily costs of water handling may be increased, since so much more water is being handled, but oil production is usually increased so much that cost per barrel of oil is reduced.

Dowell engineers regularly design fracture treatments to minimize water pumping costs.

QUESTION:

Will fracturing costs reduce net profits?

ANSWER:

Fracturing costs have been negligible when compared with the savings realized. When successful fracturing programs are employed, fewer wells are required and well spacing can be wider. Since frac jobs are considerably less expensive than the drilling of new wells, the investment required for a given flood is decreased rather than increased by a successful, well-planned fracturing program.

When a successful fracturing program is initiated, daily production is increased while operating costs are affected little if at all; the result is lower operating costs per barrel of oil.

Dowell-engineered fracturing programs have been outstanding in helping waterflood operators increase net profits.

To summarize, waterflood operators have everything to gain by checking on the advantages of fracturing wells in a flood. For full information, call your nearest Dowell representative. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

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get deeper, both completion and drilling costs will increase. However, it has been found that the drilling cost will generally increase at greater rates with depth than will completion costs.

Greatest expense in well completion comes from tubular goods run after reaching total depth. The installation of minimum tubular goods, where acceptable operational latitudes will allow maximum oil withdrawal and profits, is an objective that a progressive cost - conscious operator cannot afford to disregard.

Probably the sole argument in behalf of tubing - for - casing completions is economy. This one argument, however, is tremendously important. Certainly, the relative convenience of operating within conventional procedures has been sacrificed, and miniaturization of both subsurface and surface equipment has caused some painful changes in procedure and technique.

The current economic squeeze, dating from mid-1957, has forced management to examine the entire expense picture, and to consider impartially, without exception, the relative gain or loss entailed by the sacrifice of each expense item. This scrutiny is justified by seriously reduced profits which threaten economic survival. No other justification is required! Coupled with lowered profits is the fact that new projects are, geologically, less promising. Today many companies are drilling third and fourth-rate prospects which they would have bypassed in 1956.

In contrast, some major companies who have good drilling prospects have been forced to farm them out to other operators because of their inability to miniaturize their own operations and thus bring the investment requirements in line with anticipated reserves.

Management demanding cost reductions may well scrutinize the cost of their tubular expenditures, since they represent about 10 to 25% of the total well cost, and thus offer substantial opportunity for economy.

The savings to be realized are there, but a word of caution—the suitability of application to any given area must be carefully studied.

Problems arising out of the tubing-for-casing completion technique exist and arise primarily because they are new and not common to conventional procedures. Any operator using this technique should thoroughly grasp this fact, and then embark intelligently on an educational program which will most conveniently provide the responsible personnel with the necessary knowledge and skills to obtain success.

Future water-flood prospects must be prudently planned for and each reservoir must be evaluated from the standpoint of its future water-oil producing capacity. It should be pointed out that definite limitations appear for tubing - for - casing techniques. It is obvious that should it be necessary to lift large water volumes from great depths then 1¾ or 2-in. insert pumps might be needed. This size pump could be run as a casing pump inside 2⅞-in.-o.d. tubing - for - casing completion. The completion design should be based upon individual well conditions and must be selected on a merit basis.

Practical Example of Relative Costs

Assume a 4,400-ft. well depth to be singly completed. The costs of oil strings in three sizes—5½, 4½, and 2⅞-in.—are shown in Table 2.

The costs of dually completing the same wells at 4,400 ft. are given in Table 3.

History reveals. In looking back through oil's history we see a series of developments that has led us to smaller and smaller holes, and eventually the slim-hole completion was made feasible.

Some early boreholes were as large as 37 in. Tools were bulky and inefficient.

Why didn't the producers just make the holes smaller instead of going to all the expense of both tubing and casing? Because they couldn't! They simply didn't have the tools, the know-how, the quality steel, nor the equipment.

To summarize, it is apparent that slim - hole completions, and more particularly, tubing-for-casing single and multiple completions, offer an admirable solution for creating an investment picture that will permit the continued development of a healthy U. S. oil industry during the next few years.

There is no reason to believe that lifting, workover, and other costs related to production will be increased appreciably. As a matter of fact, it is entirely possible that both lifting and workover costs might actually be reduced.

Tubing - for - casing completions, like everything else, have their limitations, but it is apparent that a high percentage of the wells (possibly more than two-thirds) drilled in the U. S. could be completed and produced far more profitably as slim-hole and tubing-for-casing completions.

Table 2—Cost comparison of single completions, conventional vs. tubingless

Size, quantity and costs of surface casing	Size, quantity and costs of oil string	Size, quantity and costs of tubing string	Wellhead costs	Total cost	Size hole under surface (in.)
9⅝-in. 400-ft. $1,600	5½-in. 4,400-ft. $7,200	2⅜-in. 4,400-ft. $3,000	$1,800	$13,600	8¾
8⅝-in. 400-ft. $1,125	4½-in. 4,400-ft. $5,050	2⅜-in. 4,400-ft. $3,000	$1,800	$9,175	7⅞
8⅝-in. 400-ft. $1,125	2⅞-in. 4,400-ft. $3,950	None	$600	$5,675	7⅞

Table 3—Cost comparison of dual completions, conventional vs. tubingless

Size, quantity and costs of surface casing	Size, quantity and costs of oil string	Size, quantity and costs of tubing string	Wellhead costs	Total cost	Size hole under surface (in.)
9⅝-in. 400-ft. $1,600	7-in. 4,400-ft. $10,200	2⅜-in. 8,800-ft. $6,000	$2,500	$20,300	8¾
9⅝-in. 400-ft. $1,600	2⅞-in. 8,800-ft. $7,900	None	$1,000	$10,500	8¾

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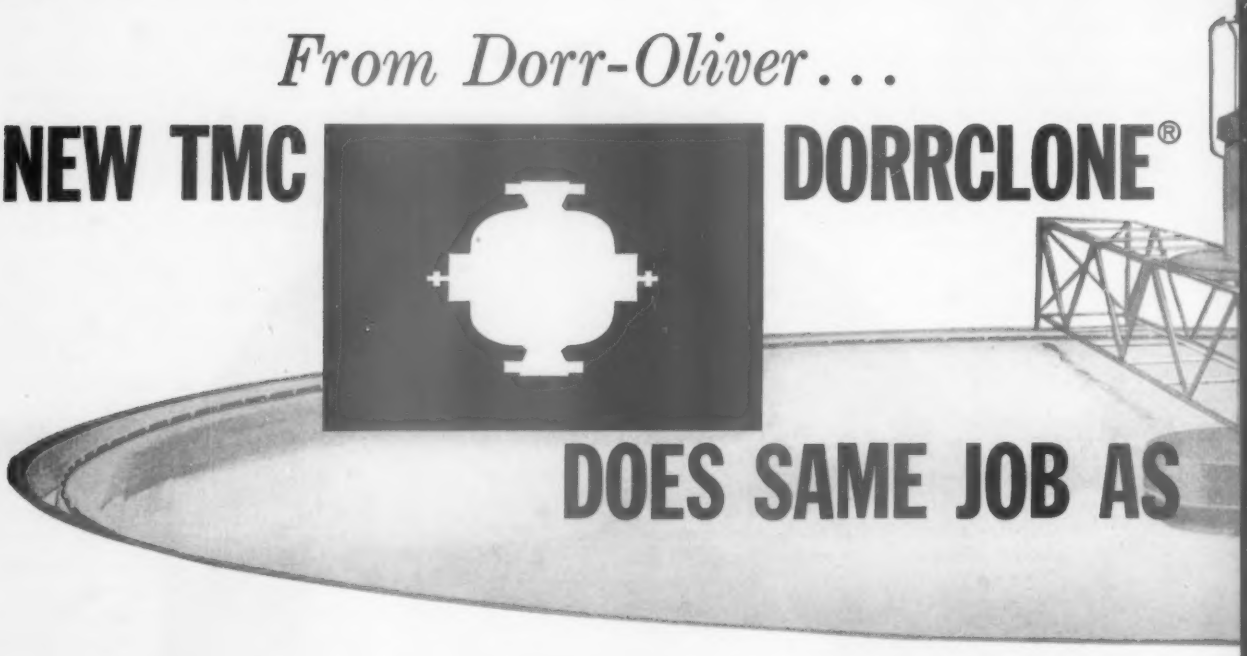

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Least electrical relaying time eases pipeline-utility conflict

Final test of the relay coordination plan is smooth integration with supply utility's system. Seeking the shortest relay time avoids most conflicts

BY O. F. ZEDLER, JR.
Humble Pipe Line Co.
AND L. U. EDISON
Westinghouse Electric Corp.

THE FINAL TEST of a relay coordination plan for a pipeline installation is its smooth integration into the supply utility's system. Since a well-coordinated over-all plan is mutually beneficial, both the pipeline and the utility can expect consideration from the other. If the pipeline engineer follows the philosophy of minimum over-all relaying time for his devices, conflicts can be avoided in the majority of cases.

In most instances, pipeline-relaying requirements are neither sophisticated nor extensive because the power systems normally used are relatively simple. The degree of protection desired depends on the intrinsic value of the equipment and its operational aspects in the over-all pumping process. Thus, the designer of pipeline electrical facilities must weigh the probable risks and consequences against cost in devising a circuit-protection plan. It should be able to prevent or minimize damage to the electrical-system component; isolate trouble to maintain continuity in unaffected circuits, and annunciate to locate and identify the type of trouble.

Presented at the eighth AIEE Petroleum Power Conference, New Orleans.

The major electrical system of an average pipeline station can be divided into three areas for protection planning and coordination: Pump unit motors and cables; station bus and feeder cable; and station main transformer. A typical coordination plan is shown in Fig. 1. Alphabetically indexed points are strategic points of coordination which will be discussed.

This considers only the so-called switchgear type of protective relays normally used with circuit breakers to protect more valuable installations. The relaying philosophy is that practiced by one specific pipeline company. There is considerable variance among designers as to the degree of overlapping and backup protection that is desirable.

Motor protection. Selection and setting of the unit motor protective relays and plotting relay curves for the largest motor is usually the first step in a relay coordination plan.

Since consideration of the unit motors fairly well dictates the selection of unit protection devices and their specific settings, it is wise to begin by examining the motor characteristics. The usual liquid pipeline pump motor is rated less than 5,000 hp., has a speed of either 1,800 or 3,600 r.p.m., and is of the squirrel-cage induction type. Its rotor is probably not intended for frequent or repetitive starts or for prolonged locked rotor operation. Ten seconds, or less, is the normal permissible locked rotor time limit. The motor may or may not have a service factor greater than 1.0 depending on its enclosure and insulation system. Its starting current will range from 500 to 675% of full-load current and the motor may be expected to operate satisfactorily with voltage variations of ±10% of rated. These motors generally have a considerable short-time overload capability though it is seldom possible to effectively utilize this asset in pipeline applications.

Specific characteristics of the motors determine the tolerable limits of operation. Relay devices to prevent prolonged operation beyond these limits may then be chosen. The usual installation will include relays to prevent damage from overloads, locked rotor, low voltage, and unbalanced currents. In addition, relays are required for motor and cable-fault detection.

When a motor is operating at rated speed, overheating may occur as a result of continuous excessive load. Usually a thermal replica-type relay (149) in two phases guards against damage of this type from low-order overloads. A typical replica-type relay will trip in a specified time at 125% of its setting. The physical setting of this relay, (point A_1) like all others, must be determined from the manufacturer's instructions.

Motor overheating can result from faulty ventilation. Air passages and filters may become dirty or snow clogged or external ventilation systems may fail. Protection is provided by temperature detectors in the stator windings arranged to alarm or trip at temperatures of 5° to 10° above the insulation thermal rating.

Stator temperature detectors and thermal replica-type relays are not usually considered adequate for locked rotor protection of a large pipeline pump motor. One induction disk relay (151), long-time (40-second) type, is used. The pick-up (Tap) setting for the disk portion of this relay should be high enough to prevent its operation ahead of the thermal relays (point A_1) and is designated as point A_2

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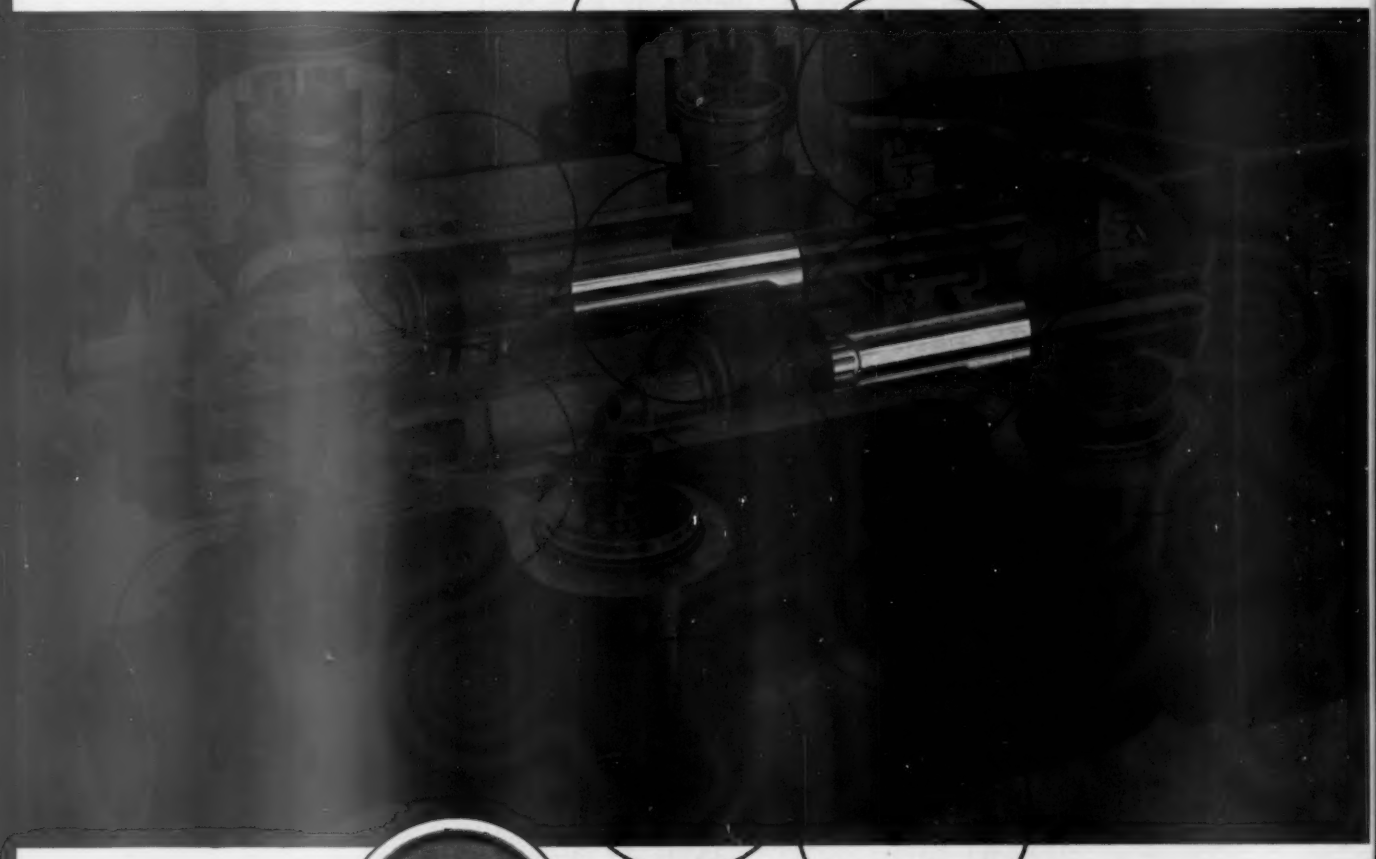

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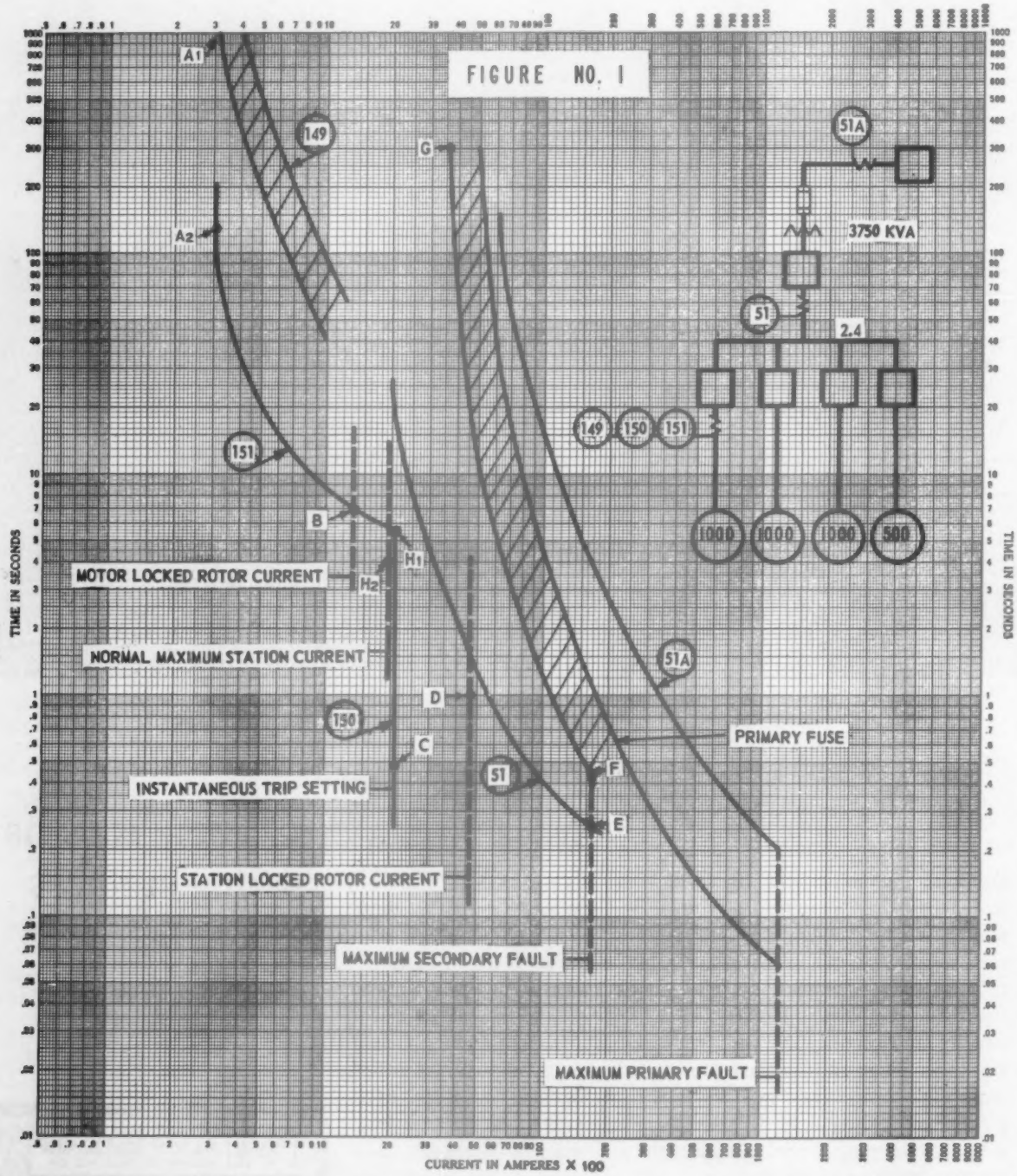
on the coordination chart below.

By keeping the pickup setting as low as normal overloads will permit, some degree of backup can be obtained for the thermal overload relay as well as faster tripping on large overloads resulting from mechanical failure in the pump unit.

Experience has shown that the intermediate range induction relay (2-6 amp.) offers more flexibility than the 4-12-amp. relay in obtaining this degree of protection. The time setting of the induction disk should be low enough to cause tripping before the permissible locked rotor time is exceeded.

Generally, a locked rotor trip time of 7 seconds will prove adequate for a 10-second rated motor which accelerates to full speed in 3 or 4 seconds. This point is designated B on the chart. The time setting must of course be determined by applying the symmetrical inrush current to the relay manufacturer's time curve.

Overcurrent relays. Instantaneous overcurrent relays (150), one for



TYPICAL COORDINATION plan for the major electrical system of an average pipeline station. Alphabetically indexed points are strategic points of coordination discussed in this article. Fig. 1.

each phase, are provided for the detection of fault currents above locked rotor current values. These overcurrent relays are generally solenoid devices included in the induction disk and thermal relay cases. They operate without intentional time relay and must therefore be set above locked rotor current to avoid tripping during startup. Their speed is such that current asymmetry must also be considered when making their pickup setting.

The relay pickup value or set point would then be the motor-starting current multiplied by the asymmetrical factor plus a 10% allowance to avoid nuisance tripping on overvoltage. In practice, a factor of 1.5 to 2.0 is generally used as shown by point C.

For motors above about 2,000 hp., differential relaying can also be justified to minimize damage from internal faults. Six motor leads and extra CT's are required.

A voltage-sensing relay is needed to trip the unit breaker if the supply voltage drops below 90% of the motor rated voltage and persists for longer than about 1 second. The time delay should permit the motor to ride through a momentary disturbance but assure that it is disconnected on a prolonged outage. If possible, the relay should be set to trip the unit for voltage disturbances which cause appreciable motor deceleration because the combined "stall" current of all units (point D) may trip the station breaker or produce a voltage drop on high-impedance systems which will prevent successful reacceleration.

Placing the voltage relay in the unit's control circuit enables it to sense the continuity of the control-circuit voltage as well as the supply voltage. It is desirable to monitor the trip circuit voltage since the inability to stop a unit causes considerable concern. Where the control and trip circuits use a common voltage source, the one relay will provide three-way protection.

In switchgear that employs d.c. tripping, additional circuitry or relaying may be included to guarantee tripping ability. Some systems are arranged to alarm on low d.c. trip voltage and automatically trip the station breaker before this voltage falls below the minimum required to actuate the unit breaker's trip mechanism.

Protection for the individual units from overheating caused by unbalanced phase currents is provided by including a relay which compares these currents. Usually it is necessary to employ one of these relays on each unit starter since the range of possible station current, for a multiple-unit installation, is so great that adequate sensitivity cannot be obtained with a single station relay.

Minimum sensitivity with the type of relay generally used is about 15% unbalance. The desired setting is usually the minimum tap which will permit starting rather than a higher tap based on expected full-load relay current. This is permissible since the relay coils are usually rated for considerable continuous overload.

Feeder, bus protection. It is customary for a station to employ a main breaker. It is usually placed in the substation to protect the main feeders as well as the station bus and its associated equipment. Protective devices as well as overcurrent relays and where experience indicates, a single, phase-reversal relay, are connected to trip this breaker.

These station breaker overcurrent relays (51) are next in the coordination study. The relays are induction disk type without instantaneous trip attachments. Their pickup current and time lever setting must give a time current curve which will coordinate with the unit relay curves. In a unit fault, the station relays must hold out long enough to allow removal of the affected unit by its relays and breaker. A clearance between relay curves of 0.25 to 0.5 seconds is generally considered necessary for proper coordination. Thus the chart point E shows the minimum time permissible for the main breaker's relays, under maximum fault conditions, to allow coordination with the unit instantaneous trip devices.

The position of the upper end of this curve is limited by points H_1 and H_2. Point H_1 is the knee of the unit relay curves; point H_2—the normal maximum station current—is the vector sum of the inrush current of the largest unit plus the full-load current of all others. For complete coordination the station relay curve should clear point H_1.

On some cases it may be difficult or impossible to obtain this clearance and the 51 curve must be shifted toward H_1 to permit coordination of the transformer primary fuses. Moving the 51 relay curve below H_1 is not desirable because some coordination is lost. A unit fault of a magnitude less than the instantaneous trip setting could then conceivably trip the main rather than the unit breaker. In some cases, however, such a setting may be necessary but under no circumstances should the 51 curve be shifted to a point H_2 where the combined unit currents would cause the station breaker to trip ahead of the unit breaker.

The station overcurrent relays are also expected to protect the main feeder cable against damage by faults beyond this cable. A fault on the station bus should be cleared before the main cable is damaged by overtemperature. To verify this, several points of the cable time-current damage curve should be plotted. These points should include the maximum secondary fault as well as several lower-value fault currents. The cable curve should fall above the station relay curve with at least the clearance of 0.25 to 0.5 seconds. If this clearance is not found, larger cable should be used or the 51 relay shifted, with the cautions in mind, until satisfactory clearance is obtained. This is seldom a problem.

It is not customary to attempt to provide moderate overload protection for the main feeder cable. It should be sized adequate for all loads involved and fault protection only provided.

Transformer protection. The main transformer may be owned by the pipeline or by the utility. It will probably be fused on the primary

DISCOVERY ABOUT COMPOSITION

New scientific

SOCONY MOBIL scientists have made a basic discovery about the *composition* of petroleum which also helps solve the mystery of its *origin.*

For the first time, two specific portions of the chlorophyll molecule have been conclusively identified in petroleum. These substances—pristane and phytane—had eluded petroleum researchers for a century. Most scientists doubted that they existed in oil even as mere traces. Socony Mobil scientists have succeeded not only in *identifying* these chlorophyll derivatives, but also in *isolating* them in pure form.

It all began in 1957, when Joe Bendoraitis and Belva Brown were checking some mass spectrum studies of petroleum in a Socony Mobil laboratory. They noticed that the sawtoothed line on the graph had some peaks that stood out like Mount Everests in the otherwise orderly pattern.

It seemed almost futile to the two scientists to try to determine precisely what substance caused the peaks, since petroleum contains perhaps *hundreds of thousands* of different components. Nevertheless they set out to try.

In late 1959 Len Hepner joined them. He was one of the first scientists to use a new instrument, the gas chromatograph, to study the higher boiling ranges of petroleum. With it he could perform in hours work that would have taken months with former methods. He isolated from a sample of petroleum a single drop of the substance that was causing the high peaks.

The three scientists were now beginning to

Research technologist Belva Brown analyzing "mass spec" charts. A University of Texas mathematics graduate, Mrs. Brown worked with the Signal Corps before joining Socony Mobil in 1946. Her leisure activities: oil painting and photography.

Len Hepner, senior research chemist, graduated from the University of Pittsburgh in 1946. His work with the gas chromatograph isolated pristane and phytane from petroleum—and led him to neglect his hobbies of bridge, bowling and tennis.

OF PETROLEUM

knowledge also sheds light on its origin

approach an answer.

Mrs. Brown, with 10 years of "mass spec" experience, kept searching her files of charts for a clue as to what substance showed peaks like that. Finally, she found one with a similar pattern.

This substance was a derivative from shark-liver oil—which contains some pristane. But the biggest source of pristane is chlorophyll, the abundant green constitutent of plants and algae.

What about the peaks Mr. Bendoraitis and Mrs. Brown had detected in the mass spec chart *from petroleum?* Did *they* indicate the presence of pristane?

The three Mobil scientists were positive they did. Their discovery so startled them that they almost doubted it themselves. But they set about proving their findings, step by step. Identifying and isolating pristane had taken four years, since the research had to be sandwiched into their regular assignments. *Proving* they had found it was to take another year.

They now called on new and powerful analytical tools, some of which Socony Mobil was the first oil company to use. They applied nuclear magnetic resonance spectrometry, infrared spectrometry, and hi-mass spectrometry—in unique fashion in many instances. In the process, they discovered a *second* chlorophyll derivative—phytane—and identified and isolated it.

All the tests confirmed their findings. Pristane and phytane are present in perceptible quantities *in petroleum. They can be isolated. And the existence of these two chlorophyll derivatives in petroleum supports the theory that oil was formed through the conversion of material derived from plant and animal life.*

This discovery is so important to fundamental petroleum research that a paper describing it has been recommended by the U.S. Committee for inclusion at the Sixth World Petroleum Congress to be held in Germany in 1963.

Joe Bendoraitis, Belva Brown, and Len Hepner are among the 1,500 men and women engaged in Socony Mobil's $25,000,000-a-year research program—in which imagination is turned into ideas, and ideas into better products and processes.

Probing the far frontiers of science pays off not only for Mobil, but for everyone who does business with Mobil—customers, employees, licensees, and investors.

Senior research chemist Joe Bendoraitis uses nuclear magnetic resonance spectrometer in verifying discovery of chlorophyll derivatives in petroleum. A ham radio operator, photographer, bowler, and stamp collector, he is earning his Ph.D. at night.

Mobil

SOCONY MOBIL OIL COMPANY, INC., 150 E. 42ND ST., NEW YORK 17, N. Y.

and these primary fuses must be considered in the coordination study. It is desirable but not necessarily essential that these fuses coordinate with the station-breaker relays. These fuses should coordinate with the utility's phase relaying (51A for example).

Because the many variables affecting the primary fuses and because of the large short-time overload capabilities of transformers, it is not practical nor desirable to attempt to protect the transformer with fuses from moderate overloads. The uses are principally intended for transformer-fault protection.

Because of the number of fuse types and elements it is wise to seek the recommendation of the manufacturer when selecting the fuse rating. The ideal fuse should provide desired fault protection and coordinate with the station main breaker and utility system phase relays. Two time-current curves for the fuse, the damage curve and the total-clearing-time curve, are needed for coordination studies. Where the damage curve is not available, it is customary to use 75% of the melting time as the damage time.

It may be difficult or impossible to obtain the desired clearance between the fuses and relay curves. There may be insufficient room between the station and utility's relays for the fuse. In others the fuse curve will not adequately clear the station relay curve on large values of fault current as shown by points E and F.

When perfect coordination cannot be obtained, clearance between the station breaker relaying and fuse curves is generally sacrificed to obtain coordination between the unit and station relays and between the primary fuse and utility's phase relaying. Coordination between the transformer primary fuses and utility's ground relaying is generally not obtainable. This situation is usually accepted.

Ground relaying. An intentionally grounded system and ground relaying will provide a considerable improvement in over-all service continuity on systems where it is impossible to obtain adequate coordination of the phase relaying. Ground relaying also gives a considerable improvement in fault-clearance time. A single induction-disk-type relay, having some degree of inverseness, can be added to each starter and main breaker for this duty. Since these relays are not subject to load or inrush currents, their pickup and time-lever settings can be set considerably lower than the settings on the phase relays.

Systems operated at 4.16 kv. and higher should be grounded to prevent prolonged and unnecessary stressing of motor insulation caused by undetected and sustained operation with one phase grounded.

When selecting a grounding method, resistance grounding may be desirable to limit ground-fault currents and thus reduce equipment damage during ground faults. The transformer primary fuses cannot however detect low value secondary ground currents and may permit excessive damage during a transformer ground fault on such a system. For this reason, solidly grounded systems are used where primary fusing is employed. When a primary breaker is available resistance-grounded secondary systems are feasible. A voltage or current relay in the grounding resistor circuit can be used to trip this breaker to provide protection for low-value ground-fault currents.

NELSON COST INDEXES

Refinery construction (1946 basis)

Explained on Page 101 of the issue of August 5, 1957

	1950	1954	1957	1959	1960	Aug. 1961	Sept. 1961‡
Pumps, compressors, etc.	138.2	166.5	206.7	226.5	228.3	229.3	229.3
Electrical machinery	134.9	160.0	188.9	195.8	195.2	192.7	190.6
Internal-comb. engines	126.0	150.5	173.9	178.5	180.7	181.6	181.2
Instruments	127.8	154.6	187.4	201.0	202.5	207.5	207.5
Heat exchangers	140.0	171.7	203.6	178.9	194.0	186.3	191.5
Misc. equip. average	*126.2	160.7	192.1	196.1	200.0	199.5	200.0
Materials component	149.5	174.6	201.9	207.8	207.6	207.9	208.3
Labor component	144.0	183.3	208.6	231.6	241.9	251.5	252.0
Nelson construction index	146.2	179.8	205.9	222.1	228.2	234.1	234.5

Refinery operating (1956 basis)

Explained on Page 171 of the issue of June 1, 1959

	1946	1952	1954	1959	1960	June 1961	July 1961
Fuel cost	49.6	81.0	86.5	103.5	109.9	106.1	104.0
Labor cost	73.1	88.7	90.9	102.3	100.3	104.3	101.4
Wages	52.4	81.5	88.7	111.5	113.0	120.8	121.7
Productivity	68.3	90.2	97.1	109.0	112.9	115.8	120.0
Investment, maint., etc.	51.2	83.6	92.0	113.7	116.9	119.2	119.6
Chemicals cost	37.0	72.1	85.7	107.8	114.3	104.0	103.2
Operating cost indexes:							
Refinery	58.5	80.5	88.7	106.8	108.8	109.1	106.9
Process units†	62.9	82.2	88.4	106.0	107.2	108.3	106.6

*Used in computing the Nelson Index until April 1952. †Add separate index for chemicals, if any are used. ‡Preliminary.

These indexes are published in the first issue each month. They are compiled by W. L. Nelson, technical editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the months of January, April, July, and October.

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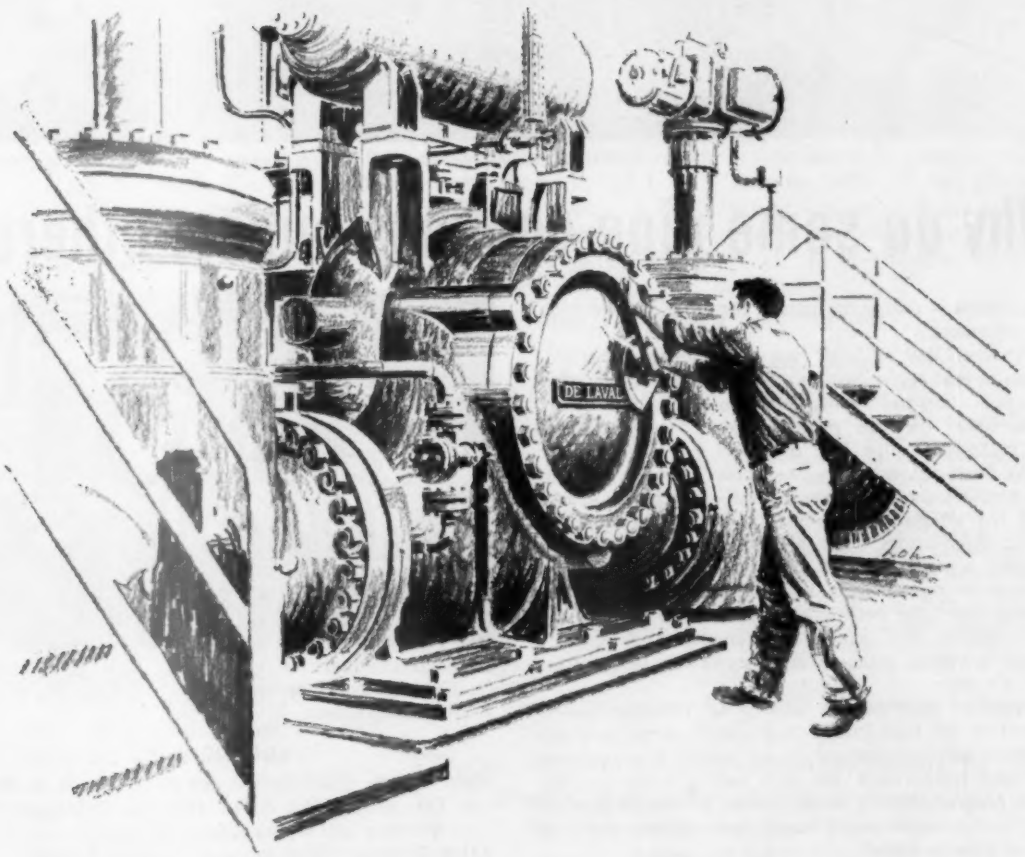
De Laval Steam Turbine Co., Trenton 2, New Jersey.



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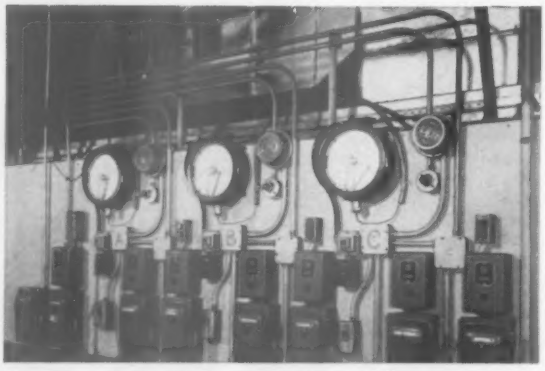

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BETTER COATINGS THROUGH RESEARCH

PLASTIC APPLICATORS, INC.

New foaming agents for tough gas-well cleanout

Some oils and some oil and brine mixtures resist ordinary foaming agents. And other agents promote corrosion by scrubbing protective oil coatings from pipe surfaces. Here are some recent advances in foaming agent technology that will help solve these operating problems.

BY H. N. DUNNING, J. B. THIELEN, AND D. L. ANDERSON
General Mills, Inc., Minneapolis

FOAMING AGENTS for the removal of liquids and solids from gas wells have been in use only a short time.[1]

But there have been enough successful jobs, in various types of field tests, to show that the method works.[2 3 4] And gas producers are more than enthusiastic.

A recently published booklet, Bureau of Mines Monograph 11,[3] describes chemicals and methods that work in most situations. But a few specific problems are unresolved:

- Foaming agents for mixtures of oil and brines.
- Improved agents for foaming oils.
- Agents to provide corrosion inhibition.

Research in General Mills' laboratory has resulted in advances in each of these areas. Standard test methods have been used, including the Bureau of Mines dynamic foam test[3] and the static NACE corrosion test.[7]

Oil-brine mixtures. The problem of foaming mixtures of oil and brine is particularly difficult. Here, the foam formed by nonionic agents is usually broken by the oil; most anionic and some cationic agents are used up in forming emulsions. Earlier work[2 3] showed that some high-molecular-weight quaternaries (cationics) were promising for this purpose. The best agents listed, however, were not comparable to the common foaming agents for water.[3]

Extensive research has supported these conclusions and also has shown that a few new fatty quaternaries are as effective in mixtures as the well-established agents are in water. Designations of the agents studied are listed in Table 1. Results obtained by the Standard Bureau of Mines test are summarized in Table 2. Performance of the low-molecular-weight quaternary agent is compared to the performance of the best anionic, nonionic, and amphoteric foaming agents in Fig. 1.

These results are typical of the performance of good foaming agents of each of the several types. The anionic agent (No. 8) is effective in brine but its performance decreases rapidly as the oil content of the mixture increases. Cationics (e.g., No. 7) are fairly effective foaming agents in brine or in kerosine,[3] but are ineffective in mixtures. The amphoteric (No. 10) is effective in brines, and will tolerate a considerable amount of oil, but is ineffective in oil. The best nonionic agent tested

Table 1—Foaming agents studies

Agent No.		Description
1	Alifoam 1	High-molecular-weight fatty quaternary ammonium chloride
2	Alifoam 2	High-molecular-weight fatty quaternary ammonium chloride
3	Aliquat H226	High - molecular - weight hydrogenated fatty quaternary ammonium chloride
4	Alifoam 4	Lower - molecular - weight fatty quaternary ammonium chloride
5	Alifoam 5	Amphoteric, N-subst. amino acid
6	Alifoam 6	Amphoteric, N-subst. amino acid
7	Cationic (commercial)	High-molecular-weight fatty quaternary ammonium chloride
8	Anionic	Lauryl sulfate plus amide builder
9	Nonionic	High-molecular-weight polyethexylated alkyl phenol
10	Amphoteric (commercial)	Sulfated ethoxy product

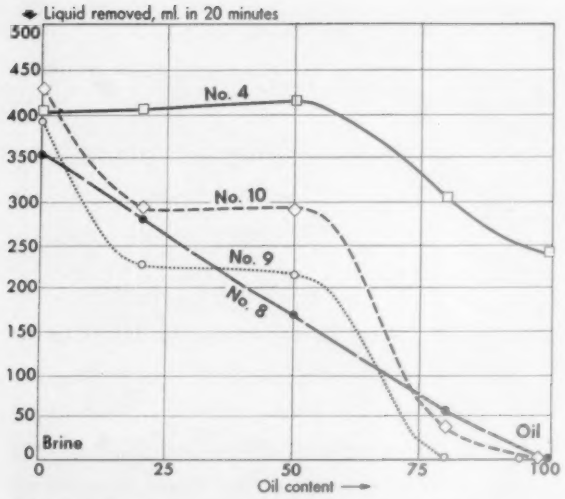
Alifoam and Aliquat are registered trademarks, General Mills, Inc., Minneapolis.

Table 2—Lower-molecular-weight quaternary is effective foamer for oil-brine mixtures

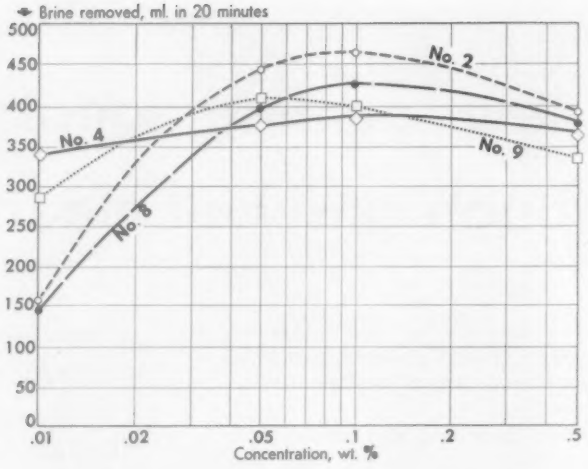
(0.5 wt. % active ingredient in mixtures, 0.05 wt. % in brine)

		Volume of liquid removed† (ml. in 20 min.)				
	Brine,‡ %	100	80	50	20	0
Agent No.*	Kerosine, %	0	20	50	80	100
1		300	260	210	100	220
3		90	50	120	310	350
4		400	400	430	305	240
5		370	385	320	80	0
6		325	330	310	70	0
7		440	160	0	0	280

*See Table 1 for description. †Standard Bureau of Mines method.[3] ‡10% sodium chloride.



OIL-BRINE MIXTURES are foamed best with a low molecular weight quaternary agent. Effectiveness of agent No. 4 extends well beyond the 50% oil point. Fig. 1.



IDEAL FOAMING AGENT is one that is effective over a broad range of low concentrations. Agent No. 4, in a 10% NaCl, 1% $CaCl_2$ solution showed excellent foaming tendencies at concentrations from 0.01 to 0.5%.

(No. 9) resembles the amproteric in effectiveness—good for brines but ineffective at high oil-brine ratios.

The low-molecular-weight quaternary (No. 4) is the most generally effective agent studied to date. Its performance actually increases slightly until the kerosine content of the mixture is greater than 50%. Furthermore, its performance still is acceptable (at 0.5 wt. % active ingredient) in mixtures of higher kerosine content.

Although the basic phenomena of foaming in oil and water mixtures are obscure, general characteristics can be established. As predicted previously,[3] the lower-molecular-weight fatty quaternaries are most effective. As shown in Table 2, foaming properties of various quaternaries differ widely. Several quaternaries are effective in various proportions of oil and brines. However, the more typical quaternary foamers such as agents Nos. 1 and 7 are ineffective in the broad middle region where water and brine are present in nearly equal proportions.

The lower-molecular-weight quaternary (No. 4) is effective across the range of brine-oil mixtures and maintains its foaming ability in kerosine. This broad range of effectiveness makes this agent suitable for most mixtures or for wells where the type of liquid is not known precisely.

Oil or Brine

Agent No. 4 is very effective in mixtures of oil and water in varying proportions. A higher-molecular-weight quaternary (No. 3) was even more effective in straight oil. Agent No. 3 removed an average of 350 ml. of kerosine from the standard column. Another high-molecular-weight quaternary (No. 2) in a different solvent was effective for brines, removing 430 ml. of brine in the standard test. Thus, agent No. 2 is effective for brines, and agent No. 3 is most effective for straight oil. Agent No. 3 is effective in oil-rich mixtures, but does not have the broad range of agent No. 4.

These results emphasize the importance of proper testing of specific well liquids.

Concentration requirements. Results discussed above show that quaternaries are effective foaming agents. Often they are more effective as concentration is decreased. Results of further studies of concentrations needed in brines are shown in Fig. 2. Performance of agent No. 4 is particularly noteworthy. A recent review of foaming[5] shows that there should be an optimum concentration for any given foaming agent, Fig. 2. The optimum concentration of the several foaming agents in the brine (10% NaCl, plus 1% $CaCl_2$) appears to be about 0.05 to 0.10 wt. %. The lower-molecular-weight quaternary (No. 4) is relatively insensitive to concentration effect. This is a decided advantage in practical use where the amount of liquid in a gas well can be only roughly estimated. The low concentration

Table 3—Lower-molecular-weight quaternary (agent No. 4) is effective in heavy brine and strong acid

Liquids	Agent conc. %	Liquid removed (ml. in 20 min.) 0.01	0.05
10% NaCl		340	400
10% NaCl, 1% $CaCl_2$		350	370
20% NaCl, 5% $CaCl_2$		400	*200
5% HCl		275	410
10% HCl		275	400
15% HCl		260	410
25% HCl		280	410

*Concentration too high for heavy brine.

Table 4—Quats give corrosion inhibition even at low concentrations (NACE test No. 7)

Agents	Corrosion inhibition, (%) 100 p.p.m.	25 p.p.m.	10 p.p.m.	5 p.p.m.
1	94	92	95	89
2	97	95	93	52
3	98	92	70	42
4	91	87	88	43

that can be used effectively is significant; commercial foaming agents are commonly used at concentrations of about 0.2 wt. %.

Part of the foaming agent is sometimes lost by adherence of viscous liquids to the great lengths of pipe and casing found in gas-well applications. Because of the low cost of the chemicals used in removing fluids from gas wells, this loss is not overly serious. However, the effect per pound of agent can be greatly increased by using means of introduction to minimize this loss. Such methods have involved the use of detergent sticks[6] and water-soluble casings for the agent.

The use of pelletized agents offers even greater convenience. Pellet size and constitution can be selected to provide optimum rates of solubility in gas-well fluids.

Heavy brines. Although several commercial agents are effective for foaming fresh water or light brines, many exhibit decreased effectiveness in nearly saturated brines or those containing large amounts of divalent metals such as calcium or barium. Results above show that the quaternaries generally increase in effectiveness as the brine concentration increases. Therefore, the efficiency of agent No. 4 was determined in heavy brines and concentrated mineral acids. The results are summarized in Table 3.

These results emphasize the high efficiency of these new foaming agents, at concentrations far below those previously considered optimum.[1,3] The results also show that even very heavy brines and strong acids are easily handled.

Corrosion

Corrosion problems involved in the use of foaming agents for gas wells have received little attention. If a well is treated batchwise at infrequent intervals, there probably is little cause for concern. However, frequent batch or continuous treatments may result in extensive corrosion. Although not necessarily corrosive per se, most effective foamers are also effective detergents. Hence, they clean metal surfaces of oily films with a resulting danger of accelerated corrosion. The fatty quaternaries, on the contrary, are effective corrosion inhibitors in systems commonly encountered in gas fields.

Pertinent data obtained in the NACE corrosion test[7] are summarized in Table 4.

Normally, 90% inhibition of corrosion is indicative of a good corrosion inhibitor. Therefore, each of the quaternaries is effective at concentrations far below those used in foaming liquids from gas wells.

Field Test Results

Well A, Harrison County, West Virginia.

The well has been "wet" since it was drilled into the Benson sand and fractured a year ago. Liquid, with a trace of oil, rises in the casing, decreasing gas production, but it seldom carries over into the separator. Solid and liquid nonionic foaming agents have been used with mixed success. Attempts to flow, or blow, the well without foaming agents were never successful. The well had an open-flow potential of 270 M.c.f. per day.

Well was treated by injecting 2½ gal. of agent No. 2, and 5 gal. of water; it then was shut in for a week. This long period is unnecessary; overnight is enough. Then the liquid was foamed from the well. On previous tests with foaming agents, the first liquid was blown from the well after 15 minutes, but with agent No. 2, liquid was produced 1 minute after the wellhead was opened. With other foaming agents, previous tests had produced liquid that was predominantly water. In this test (agent No. 2) the ratio was reversed; the liquid produced was comprised of about 6 bbl. of oil and 3 bbl. of water.

Production tests showed that the well produced gas at the rate of 122 M.c.f. per day to the pipeline before the test and at the rate of 185 M.c.f. per day after the test. This agent (No. 2) was used because previously the produced liquid had been mainly water.

Well B, West Panhandle Field, Moore County, Texas.

The well produces some oil and paraffin with brine. For the year before the test it had been operated without cleaning. On April 24, 1961, a steel-line measurement showed heavy deposits, sufficient to stick the tools, at 2,224 ft.

In this treatment, 10 gal. of agent No. 5 and 30 gal. of fresh water were injected down the tubing. The well was shut in overnight. It was opened to the atmosphere the next morning and thick heavy foam poured from the tubing. Agent No. 5 was selected for the unusually heavy foam it produces in water or water with limited amount of oil. The third foam formed in this test carried considerable paraffin, in the form of chunks, from the well. Subsequent steel-line tests showed that this agent had softened the paraffin deposit. This test shows a side benefit[8] of the use of foam to remove liquids—effective wellbore cleaning.

Conclusions

Low-molecular-weight fatty quaternaries, such as agent No. 4, are most effective for foaming mixtures of oil and brine, and are effective foamers for heavy brines and strong acids.

Higher-molecular-weight quaternaries, such as agent No. 2, are highly effective in brines and straight oil.

The fatty quaternaries are effective at very low concentrations.

The fatty quaternaries are effective corrosion inhibitors and thus offset corrosion problems that may arise from the general cleansing effects of foaming agent treatments.

Acknowledgment

The authors express appreciation to Richard Hall who obtained much of the laboratory data and to Richard Bayne, Hope Natural Gas Co., Clarksburg, W. Va., for part of the field data.

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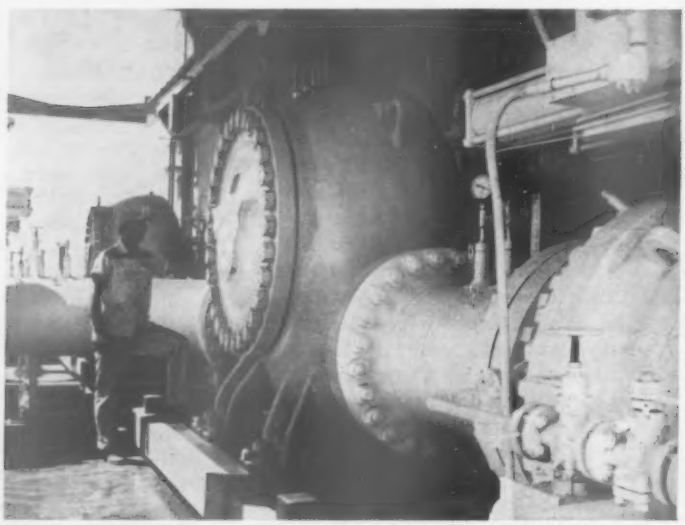
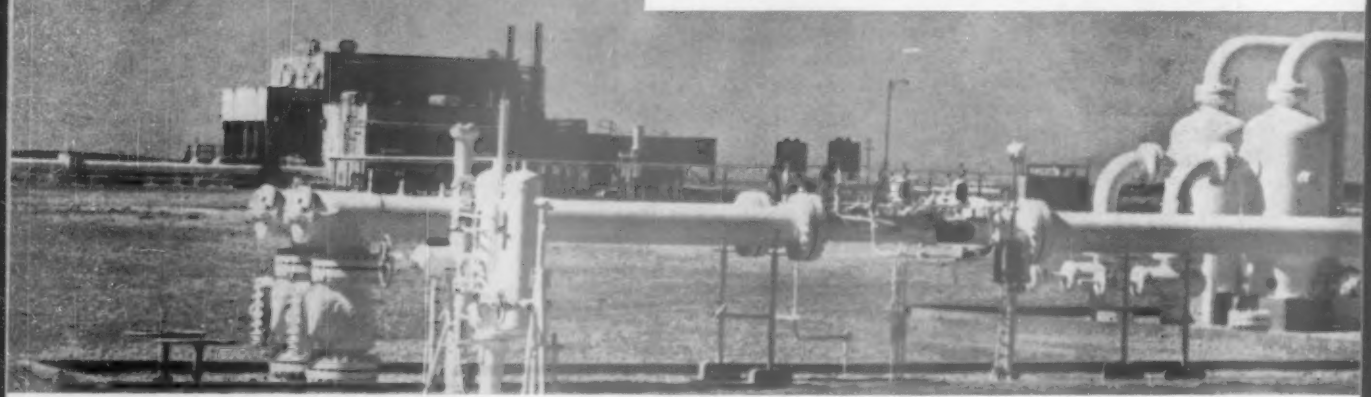
How Transwestern's 5 mainline stations operate at peak efficiency

Remote control console at Roswell operates the system's 10 Cooper-Bessemer engines and measures variables and records them periodically.



The two Cooper-Bessemer RFB-24 centrifugal boosters at Roswell. Suction pressure here is 550 psi. Discharge is 825-1008 psi.



COMPRESSION UNITS of the five mainline stations of Transwestern Pipeline Company have the highest thermal efficiency obtainable for their needs. These units consist of the combination shown: A Cooper-Bessemer LSV turbocharged gas engine driving a Cooper-Bessemer centrifugal booster. Each station has two LSV-16 engines, driving RFB-24 centrifugals through speed increasers. All 10 C-B units have given outstanding performance 'round the clock since start-up in the Fall of 1960.

The Transwestern system is certified to carry 350 mmcfd from Roswell, New Mexico, to Needles, California. It is fully automatic with remote control from Roswell, the terminal of two 24-inch transmission lines. The stations were engineered by Gulf Interstate.

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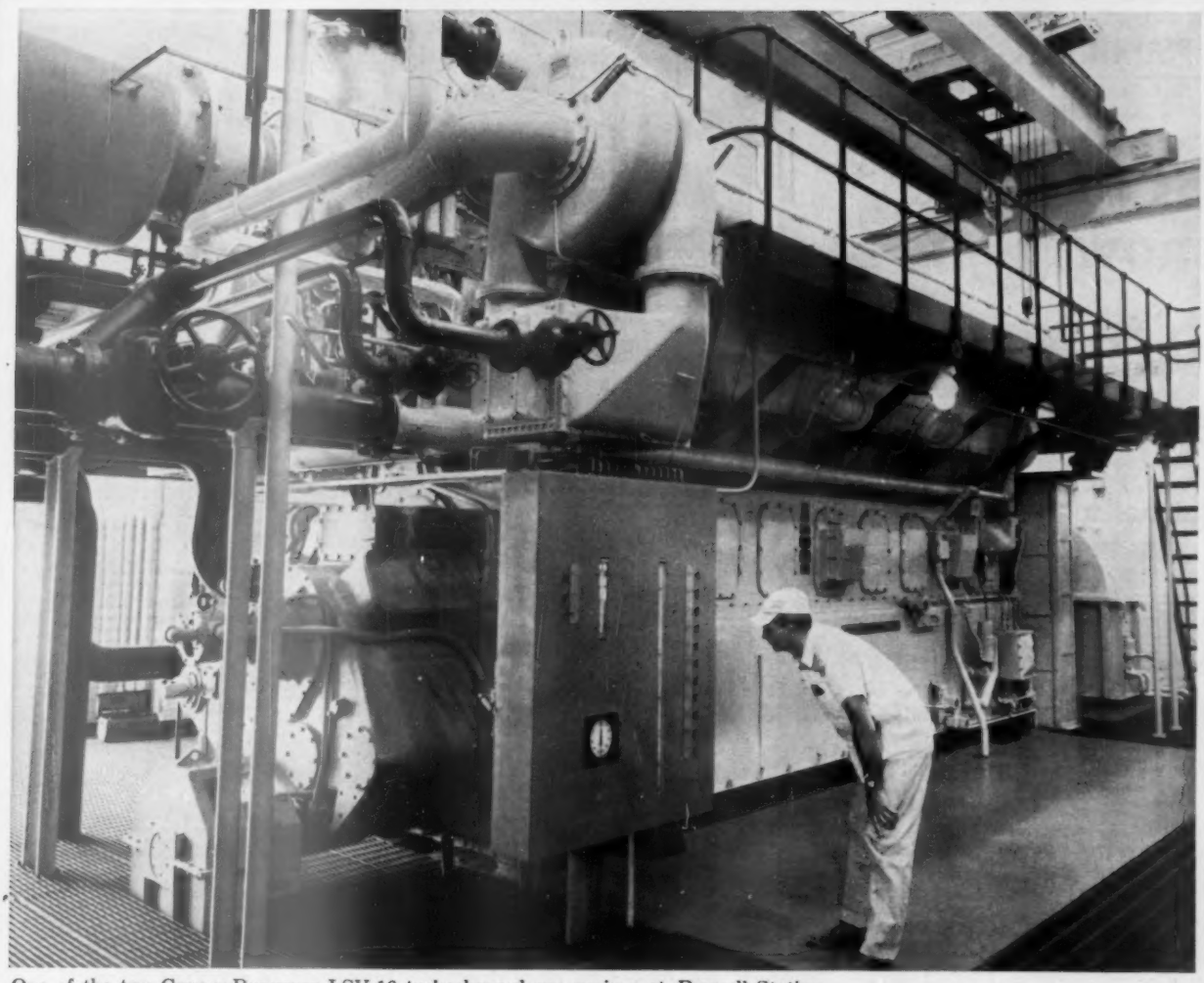
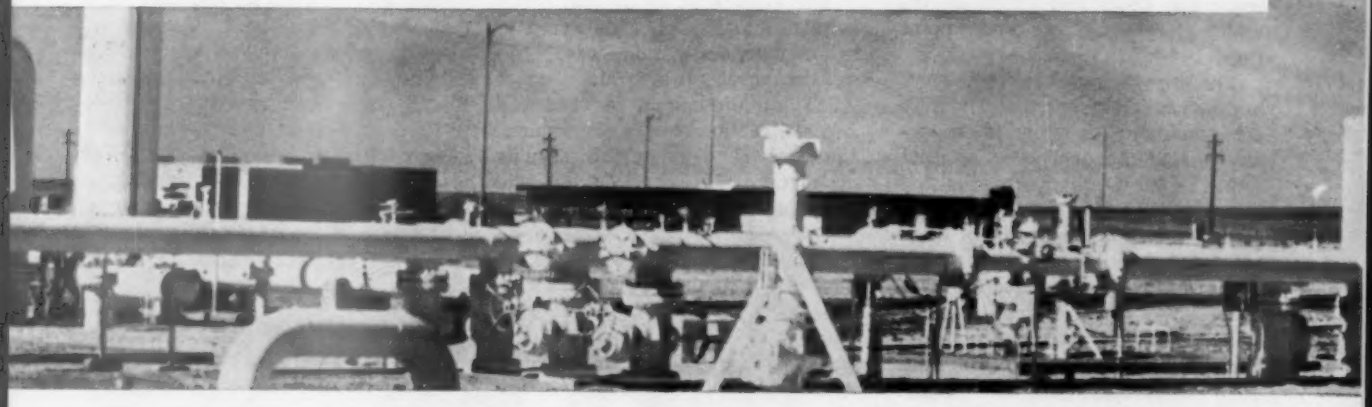


One of the two Cooper-Bessemer LSV-16 turbocharged gas engines at Roswell Station.



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PIPELINING NOTES

Oil pipelines show gains in revenues and volume

But net income and return on investment fell in 1960. Interstate lines have $3.3 billion in property, spent $152 million for equipment last year.

BY JOHN P. O'DONNELL
Assistant Pipeline Editor

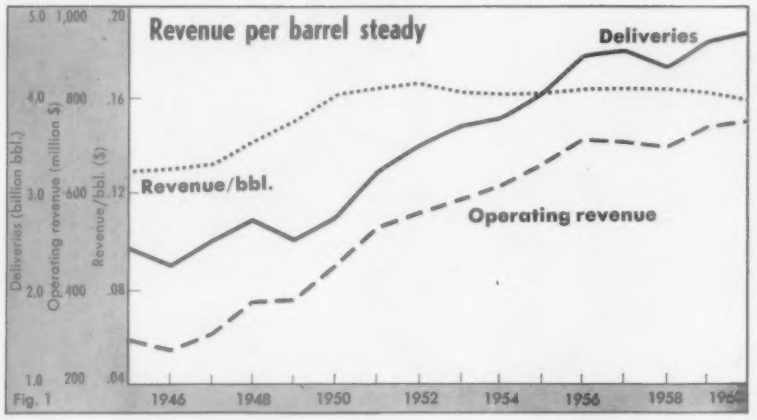

Fig. 1

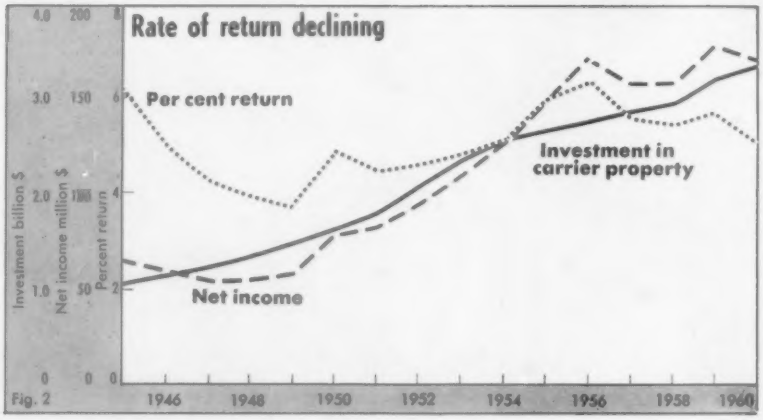

Fig. 2

NEW RECORDS both in volume and revenue were set by the interstate oil pipelines in 1960. Despite this impressive performance, net income was down and return on investment was at its lowest point since 1954.

The growth in volume and revenue makes it obvious that pipelines are continuing to grow in importance. And the decline in net and return make it equally obvious that there is ample justification for the pipelines' relentless pursuit of more efficient operation.

These companies delivered a total of 4,783 million barrels of crude oil and refined products in 1960. This was an increase of 2.7% from 1959 and represented the largest volume ever handled by pipelines.

Crude is 76%. Last year's deliveries were made up of 3,652 million barrels of crude oil and 1,131 million barrels of refined products. Crude represented 76% of the total handled and refined products 24%.

Total deliveries include the crude and products delivered to connecting carriers. About 40% of the crude and about 20% of the refined products was moved by more than one carrier.

The volume of crude and products "terminated," i.e., delivered to its ultimate destination, was 3,144 million barrels. It was made up of 2,253 million barrels of crude oil and 891 million barrels of products. Thus, of the deliveries to ultimate destination, 71% was crude and 29% products.

Operating revenues of the 82 companies included in the 1960 annual report of the ICC's Bureau of Transport Economics and Statistics reached $770 million in 1960. This was an all-time high. It compared with $765 million in 1959.

Unit return down. While total revenue reached a new high in 1960, revenue per barrel actually declined slightly. It averaged 16.1 cents per barrel last year against 16.4 cents in 1959. Revenue per barrel has held remarkably steady during the past decade. While there have been minor fluctuations since, it was exactly the same in 1960 as it was in 1950 (Fig. 1).

Investment in carrier property also hit a new high in 1960. As of December 31 it totaled $3,299 million, up $100 million from the year before. These companies spent $152 million on new construction and other improvements last year. Pipeline construction, $41 million, and line pipe, $36 million, accounts for almost half of the total expenditures.

While revenue and investment both moved up in 1960, net profit fell. The combined net of the companies covered in the report was $169.4 million. That was $13.4 million under the all-time high of the previous year when it reached $182.8 million.

Net income was down largely because of increased operating expenses and taxes. Operating expenses rose $11.5 million and taxes $6 million.

Rate of return on investment for the interstate pipelines was just a shade over 5.1% in 1960, the lowest since 1954. These companies had their best postwar year in 1956

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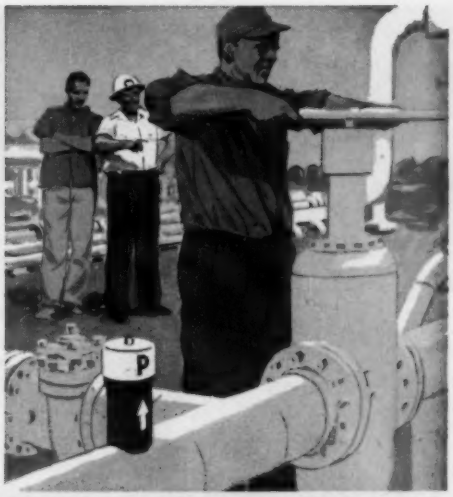
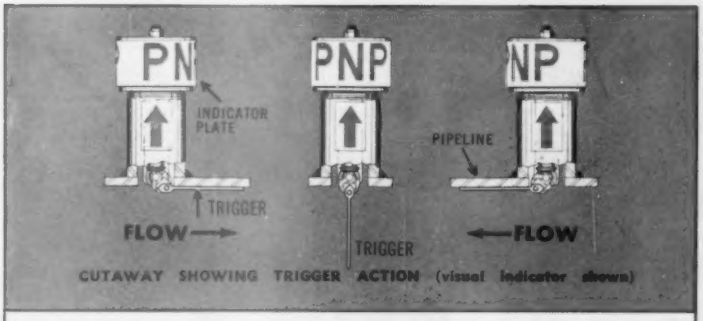
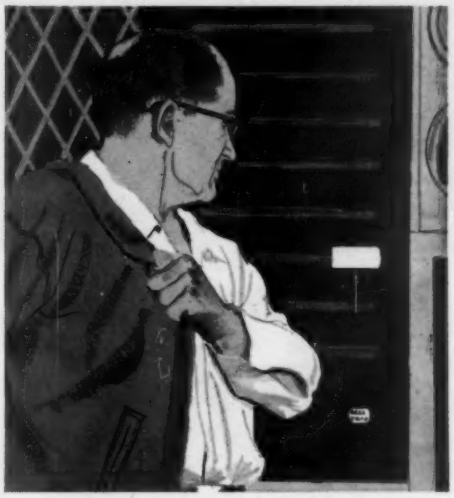




CUTAWAY SHOWING TRIGGER ACTION (visual indicator shown)

• The WmSon PIG-SIG II Scraper Passage Indicator which has earned such wide acceptance in the pipeline industry is now available with bi-directional trigger as an optional feature. The trigger is designed for use in lines where scraper travel may be in either direction and in meter proving loops. Other optional features: pneumatic control with automatic reset and automatic counter to record scraper passage.



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GAS

comes to Grandyle Village ...through Bethlehem line pipe

Iroquois Gas Corporation began laying distribution lines early in 1961 in Grandyle Village, a promising new suburb on Grand Island in New York State's Niagara Frontier. Connected to a 12-in. line laid under the river last Fall, these lines will bring gas to an initial 400 customers by the end of the year. The company estimates that, at the end of the 3-year, first-phase of the project, more than 80 per cent of the island's consumers will be hooked up to their lines. Some 170,000 ft of 2- to 6-in. line pipe will be involved, the great majority of it coming from Bethlehem's continuous buttweld and electric resistance-weld mills at Sparrows Point, Md.

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Grand Island Is Booming

Just south of the Falls, the Niagara River divides to flow around an island larger than Manhattan. Virtually undeveloped until 1935 when two new bridges provided access to the mainland, Grand Island is one of the most promising growth areas on the Niagara frontier. Home and industrial construction is booming, stimulated by far-reaching plans to bring community services—such as natural gas service—to within reach of every corner of the island.

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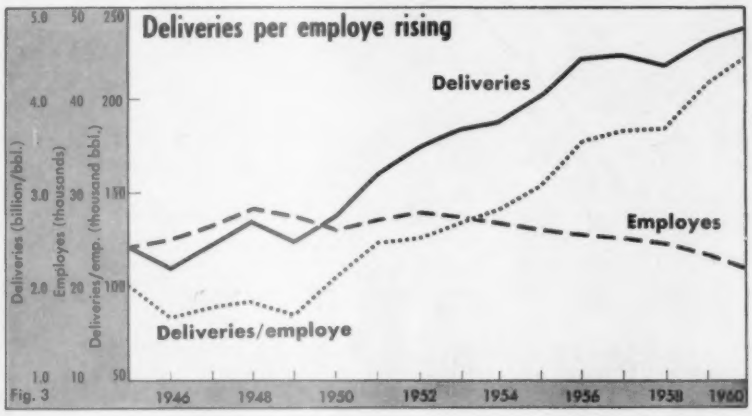

Fig. 3

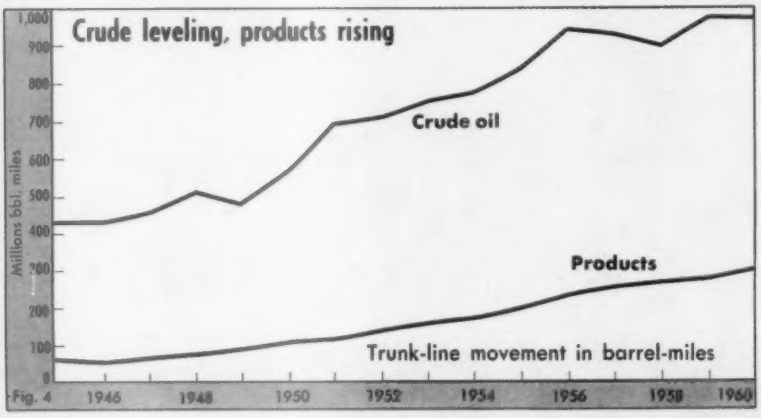

Fig. 4

when their rate of return reached 6.5%. It has been declining steadily since (Fig. 2).

Tax tops income. Over the past 10 years these companies have paid more money to government in taxes than they have earned in net income. Their taxes, federal and other, for this period amounted to $1,492 million while their net income was $1,417 million.

Probably the best indication of the companies' efforts to improve efficiency and keep their return up is to be seen in their cost of operation. Back in 1950 they averaged 9.3 cents per barrel in operating expenses. Despite the substantial increase in costs that has occurred since then, this figure was cut to 8.7 cents per barrel in 1960.

Another measure of efficiency is the productivity per employe. In 1950, interstate oil pipelines delivered 104,600 bbl. per employe and, in 1960, 224,300 bbl. This is an increase of 114% in a decade (Fig. 3).

A big change that is going on in interstate pipelining is the growing size and volume of the products lines (Fig. 4).

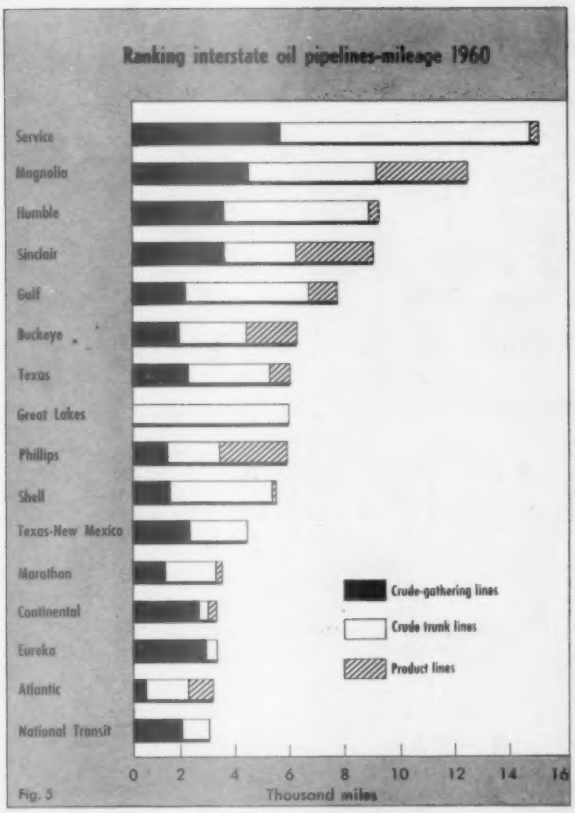

Fig. 5

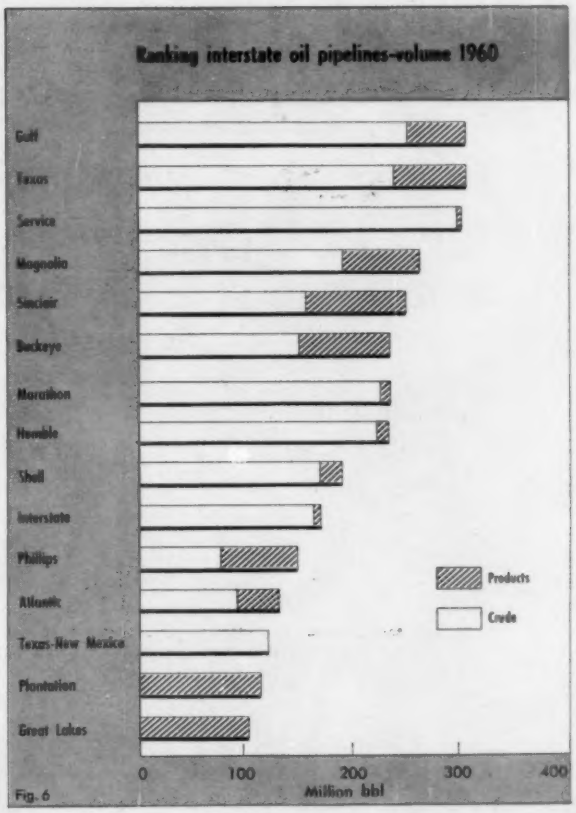

Fig. 6

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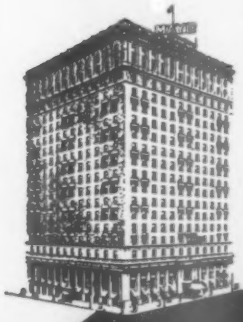

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PIPE LINE SURVEYS

Products growth. One indication of the growth in importance of products lines is their percentage of the total mileage. Back in 1951, products lines accounted for only 22% of the interstate trunk lines. By 1960, their share had increased to almost 40%.

Crude trunk lines in 1951 totaled 65,000 miles and, by 1960, had fallen back to 59,200 miles. Product trunk lines, however, increased from 18,800 miles in 1951 to 38,300 miles in 1960.

Based on mileage of lines operated, Service Pipe Line is, by far, the largest. It operates 5,494 miles of gathering lines and 9,366 miles of trunk line, all in crude-oil service, and 261 miles of products lines. Its system totals 15,091 miles (Fig. 5).

Magnolia is second with 4,414 miles of crude-gathering lines, 4,795 miles of crude trunk lines, and 3,502 miles of product lines. Other major lines are Humble, third with 9,420 miles; Sinclair, fourth with 9,039, and Gulf, fifth with 7,675 miles.

Top product lines. Great Lakes Pipe Line Co. is far and away the largest in size of the product lines. It has 5,964 miles. Magnolia's 3,502 miles put it in second place. Phillips with 2,496 miles, Plantation with 2,430 miles, and Sinclair with 2,378 miles are bunched behind the first two.

Gulf is out in front in volume. Its lines delivered 307 million barrels in 1960. Texas Pipe Line Co., with 306.8 million barrels, and Service, with 304 million barrels, were close behind. Service was the No. 1 crude carrier since comparatively little of its total volume was in products (Fig. 6).

Plantation and Great Lakes, both exclusively products lines, handled more products than any other. Plantation delivered 114.6 million barrels of products and Great Lakes 103.4 million.

This year's merger of Humble and Plantation will make a change in the volume leaders. Last year these two systems, now Humble Pipe Line Co., together delivered 415 million barrels, far more than any other present-day carrier. The merger will still leave Humble in third place in size with 12,357 miles but it will be right up there with Magnolia.

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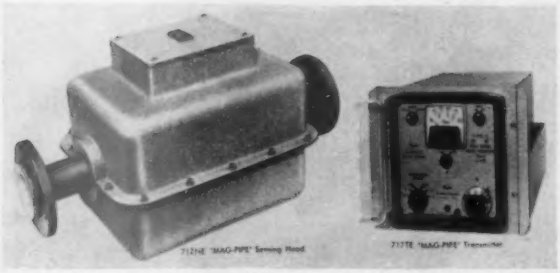
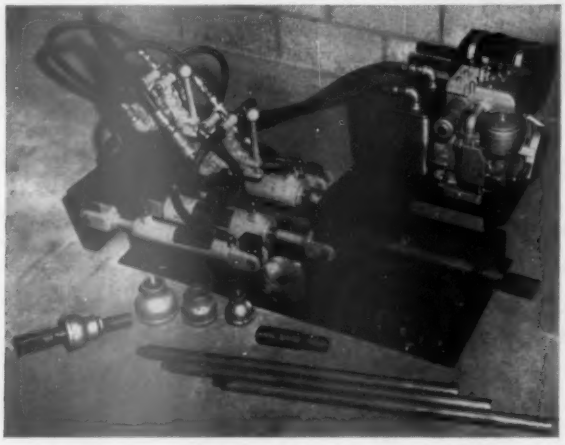


Electromagnetic flow meter

THIS electromagnetic flow meter, the Mag-Pipe, provides an output signal of 1 to 5 mg. d.c., which may be transmitted with an accuracy of 1½% up to 10,000 ft. to miniature receivers or controllers on central control panels. The flow meter is suited to many viscous liquids and reportedly will measure fluids with low velocities and with electrical conductivities as low as distilled water.

The 712N sensing head consists of a glass-fiber or Teflon-lined stainless-steel flow tube, two signal electrodes, and an a.c. magnetic circuit. Continuous onstream measurement may be made in pipes ranging in size from 1/10 to 12 in. Depending on the fluid conductivity, the fully transistorized, solid-state transmitter may be located up to several hundred feet from the sensing head. The transmitter is available for either panel mounting, rack mounting, or for ordinary field mounting. Source: **Taylor Instrument Co.,** 95 Ames St., Rochester 1, N. Y.



New method for burying pipe, cable

THIS TECHNIQUE of burying underground pipe or cable is claimed to do away with the common necessity of digging up private property and is made possible by use of the Mite hydraulic ram, a gasoline-driven 5¾-hp. compressor, and a 1 5/16-o.d. 30-in.-length pilot rod. The maker claims that in one actual application of his product, a hole was dug every 50 or 100 ft. along the site of an underground structure to assure accuracy in feeding the pilot rod and to locate existing substructures.

The Mite hydraulic ram, which is 39 in. long and 17 in. wide, was placed on the floor of a pit where it was blocked and staked. Here the customer used hydraulic jacks to eliminate wood blocking. The ram, supplying 14 tons of pushing and pulling force, pushed the 30-in. pilot rods along the route that the underground pipe and cable would eventually take. After the pilot rod reached its destination, the push head was removed from the pilot rod.

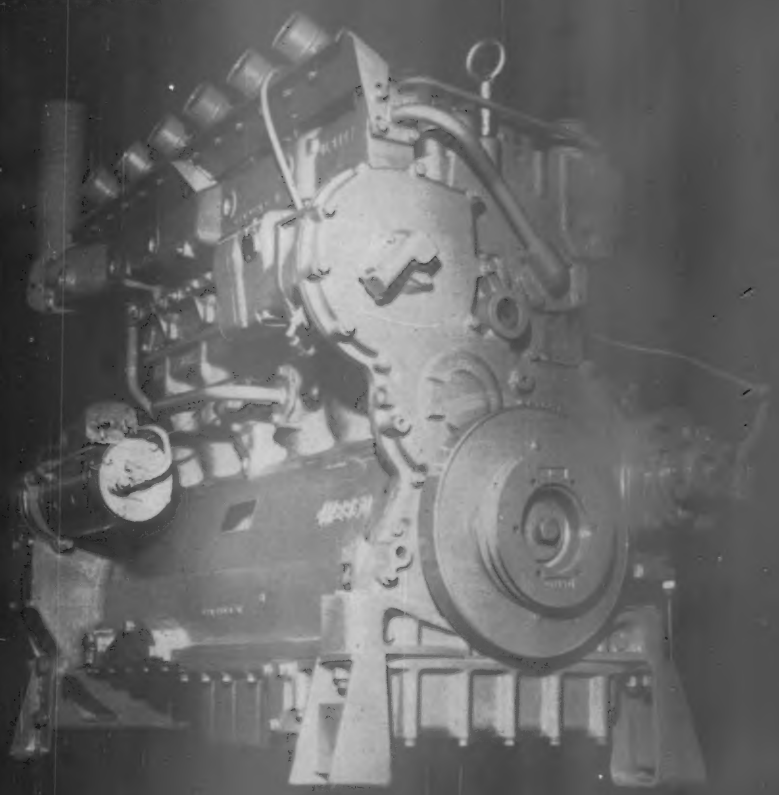
A bell reducer was attached to the pilot rod and 2, 3, and 4-in. pipe or cable was connected. At this point, the ram was ready for pulling back through the pilot hole. The maker claimed that, during a recent 15-day trial, about $2,200 was saved with the method. Source: **Mite Pipe Ram Co., Inc.,** 1210 N. Batavia, Orange, Calif.

•

Latest portable temperature probe

Recently announced, this new temperature-measuring system is designed primarily for use with granular or powdered materials. The system measures temperatures from 20° to 150° F. in out-of-reach places. Internal mercury batteries

Caterpillar announces the G333



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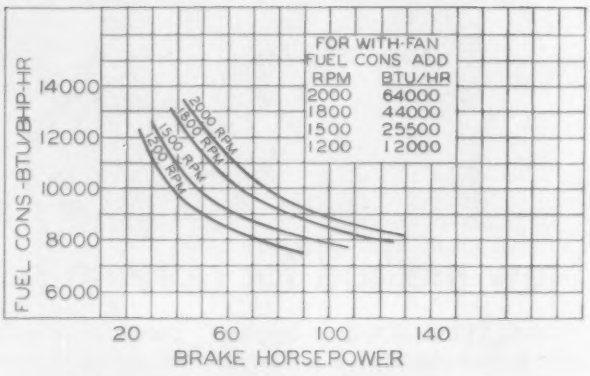
Now, the same basic features that have earned Cat Natural Gas Engines industry-wide recognition for long life and low cost operation are yours in the new G333. The compact G333, like all Cat Natural Gas Engines, is a direct conversion from its diesel counterpart giving you full advantage of diesel strength for the less strenuous demands of gas operation.

Results: Up to 25,000 hours of operation before overhaul . . . higher compression ratios for optimum fuel efficiency and increased output per cubic inch displacement . . . continuous full rated power, derating only for altitude and temperature. Another cost saving feature of the G333 is the low-tension ignition system which is standard equipment. This system makes higher compression ratios practical and extends breaker point and spark plug life.

The new G333 develops 130 HP @ 2000 RPM and 75 KW as an 1800 RPM Cat Electric Set. It is available in compression ratios of 12:1 for processed natural gas and 8.5:1 which allows burning of a wide variety of gaseous fuels, including well-head gas.

For further information on the G333, contact your Caterpillar Dealer or write direct. The Cat Natural Gas Engine line ranges to 720 HP and 450 KW.



Fuel consumption for G333 (12:1 compression ratio) based on 1000 BTU low heat value fuel.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Diesel and Natural Gas Engines • Electric Sets
Diesel Marine Engines • Diesel Truck Engines

are said to last up to 5 years, maintaining accuracy without calibration adjustment.

The system consists of a temperature meter with shoulder strap; four 3-ft., internally wired probe sections with threaded ends; and a removable sensing tip. Key element in the system is a tiny thermister contained in the sensing tip. Twenty-five-ft. temperature cables with sensing tips and meter connectors are available for permanent or semi-permanent location of the sensing tip when frequent temperature readings must be made. Source: **Radson Engineering Corp.**, Macon, Ill.

●

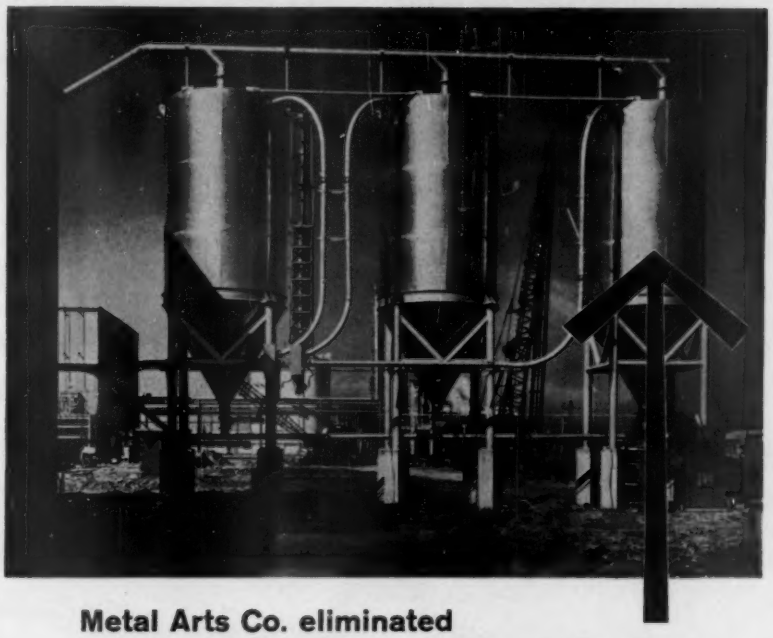
New microvapor-pressure apparatus

According to the maker, this MVP apparatus Model 1300 offers advantages over conventional Reid vapor-pressure apparatus in measuring vapor pressure of volatile nonviscous products, resulting in significant savings in gasoline blending, quality-control, and research. Also, though microvapor-pressure values are easily converted to traditional Reid values, this new appartus requires a smaller sample to duplicate the 4:1 vapor-liquid ratio specified in ASTM Method D-323 for Reid vapor pressure.

The maker claims that the new model: (1) is much easier to operate and maintain; (2) will handle any kind of sample from crude oils to high vapor-pressure aviation fuels—and the higher-boiling viscous samples above the gasoline and jet-fuel ranges; (3) has a digital readout counter; (4) eliminates the possibil-

from ALCOA

good designs made better with aluminum



Metal Arts Co. eliminated product contamination in bins and piping at Koppers polyethylene plant

Originally selected for initial low cost, aluminum proved a good design specification for bins and conveyor piping at the Koppers plant, Port Arthur, Texas. Used in polyethylene production, these units have eliminated undesirable metallic contamination of the product — thanks to the chemical stability of aluminum. Bins were designed and fabricated by Metal Arts Co., Houston. Here, again, is a case in point showing a good design made still better by the valuable chemical and physical properties of ALCOA® Aluminum. The coupon will bring you detailed information on how to make improvements in your own good designs.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America 826-M Alcoa Building, Pittsburgh 19, Pa.

Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries:

- ☐ 34-10197 Aluminum Pipe and Fittings
- ☐ 68-10460 Process Industries Applications of Alcoa Aluminum
- ☐ 34-20437 Aluminum Alloy Heat Exchangers in the Process Industries
- ☐ 50-19415 Welding Alcoa Aluminum
- ☐ 02-19051 Alcoa Aluminum Handbook

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

ANOTHER F&P
IN-LINE BLENDER
on its way to work

Final check-out of a 10-stream blender prior to shipment from the F & P Plant. "Building block" design gives full flexibility for specific applications.

You undoubtedly read about the new F&P packaged Multi-Stream, In-Line Blending Systems just a short while ago. They were praised by the technical press and hailed throughout the processing industry. Finished units are being installed by important processors.

If you are, or will be blending fluids, investigate these F&P continuous In-Line Blending Systems. Their unique electronic digital "memory"—which controls total *quantity* ratios—lets you blend any number of fluids *continuously*, right in the pipeline, to an accuracy within ½% of instantaneous rate.

Full details are yours without obligation. Write for a copy of Bulletin 91-10-06—or tell us of your interests. Also, if you'd like to see a typical system in operation, let us know. Fischer & Porter Company, 3221 County Line Road, Warminster, Pennsylvania. In Canada, write Fischer & Porter (Canada) Ltd., 2808 Jane Street, Toronto.

FP FISCHER & PORTER COMPANY

A world-wide Instrument Company with plants in Australia, Canada, England, France, Germany, Holland, Mexico and the United States.

ity of glass breakage, as in handling of mercury; and (5) has 10 times greater precision than that of the Reid method. Source: **Fisher Scientific Co.,** 381 Fisher Building, Pittsburgh, 19, Pa.

●

Proportioning pump

Used for controlled-volume pumping of chemical solutions, slurries, and liquefied gases, the Strokontrol pump uses a totally enclosed hypocycloidal arrangement of gears to provide power transmission and capacity adjustment from zero to 100% of maximum. This system of power transmission eliminates cranks, rocker boxes, and other exposed elements normally needed to convert rotary-drive motion to reciprocating pumping action.

The pump is driven by conventional electric, rotary air, or variable-speed drives and does not require any gear reduction other than the Strokontrol units. The pump is available with maximum capacities from 1.84 to 1,472 gal. per hour and for pressures to 6,500 psi. Spring-loaded double-ball check valves provide metering accuracy of ±0.5%. Source: **Jaeco Pump Co.,** Villanova, Pa.

●

Chromatographic analyzer

Featuring trend readout display for compatibility with automatic control, this new chromatographic analyzer provides measurements of up to six components on which to base control of process-stream composition. Continuous measurement trends are monitored by two pneumatic recorders, each logging the

from ALCOA

good designs made better with aluminum

Allied Chemical Corporation stores nitrate fertilizer solutions in Eaton tanks

Made by Eaton Metal Products Corp., Omaha, Nebr., scores of Alcoa® Aluminum stationary tanks store ammonium nitrate fertilizer solutions throughout the country for Allied Chemical Corp. Produced by Eaton for the same cost as coated steel, these tanks require no maintenance; lighter weight means they're easier to ship and install. Ideal for handling nitrogen fertilizer solutions, aluminum resists attack by ammoniated ammonium nitrate. For more information about aluminum tanks, pressure vessels, tank cars and piping, please send the coupon.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America, 826-MM Alcoa Building, Pittsburgh 19, Pa.

Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries.

☐ 34-10197 *Aluminum Pipe and Fittings*
☐ 68-10460 *Process Industries Applications of Alcoa Aluminum*
☐ 42-20849 *Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres*

Name_____ Title_____
Company_____
Address_____
City_____ Zone____ State_____

Only WHELAND combines these features:

Wheland HP-16000 in Kingfisher County, Oklahoma. Left to right: Lavoy "Dink" Klutts, Tool Pusher; Jimmie Lynn Austin, V.P.; Paul Austin, Treas.

P. O. BOX 1240 PHONE 2600

Jimmie Austin & Sons, Inc.

Seminole, Oklahoma

August 1, 1961

Mr. Gordon P. Street, President
The Wheland Products
Division of Gordon Street, Inc.
Chattanooga, Tennessee

Dear Mr. Street:

As you know, we have used Wheland pumps for many years. From our own experience we became convinced that the Wheland HP-14000 Pump couldn't be beat.

But your planetary HP-16000 Pump is so quiet and smooth running that we are digging more hole faster and at less cost. Part of the increased penetration comes from the fact that the HP-16000 is bigger than the HP-14000. But that is only part of the story.

The new planetary gears let us use a much smaller sheave. The cylindrical crossheads, oversize bearings and the big gear reduction make the pump easier to pull, run smoother, and do a better job.

We have used this pump in Kingfisher County, Oklahoma, and find it just right for this area.

Yours very truly,

JIMMIE AUSTIN & SONS, INC.

By Jimmie Austin
President

JA:rmm

Planetary Gears
Oversize Bearings
Big Gear Reduction
Small Sheave
and Cylindrical
Crossheads

WHELAND PLANETARY

HP-16000

Duplex Power Slush Pump
7¾" x 16", 600 H.P. at 65 RPM

WHELAND

ROTARY DRILLING MACHINERY

THE WHELAND PRODUCTS
DIVISION OF GORDON STREET, INC.
CHATTANOOGA, TENNESSEE, U.S.A.

DRAWWORKS • SLUSH PUMPS • ROTARIES
CROWN BLOCKS • TRAVELING BLOCKS • SWIVELS

DOMESTIC DISTRIBUTORS: INDUSTRIAL SUPPLY COMPANY, INC. —Main Office: Wichita Falls, Texas • HOUSTON OIL FIELD MATERIAL COMPANY, INC.—Main Office: Houston, Texas.

EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION —233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.

concentration of three components.

Sharp peak definition is achieved largely through a sampling valve which delivers a uniform slug of sample gas to the column for each analysis. A special annular slide is spring-loaded to prevent carrier gas from leaking into the sample, minimizing time lag and dead space.

Columns are U-shaped, rather than coiled, with 30 U-tubes divided into two crescents of 15 tubes each. Said to be easy to pack, clean, and repack, the tubes can be field-connected to produce any column arrangement up to 40 ft. Source: **Foxboro Co.,** 86 Neponset St., Foxboro, Mass.

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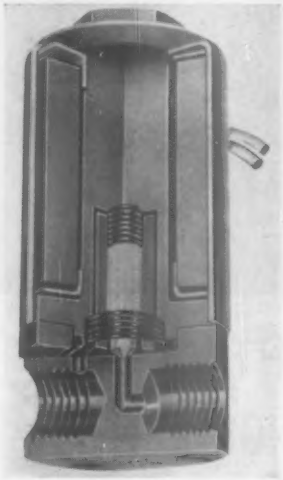


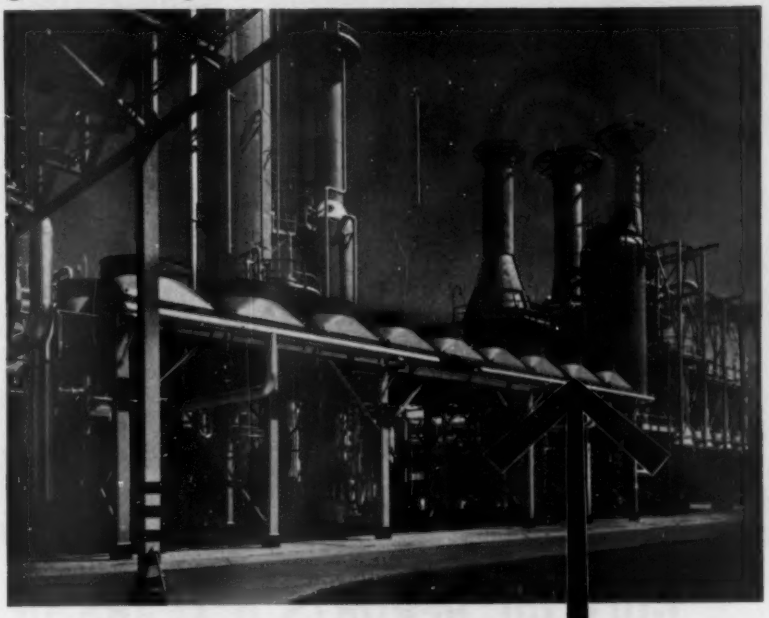
Solenoid shutoff valve

This miniaturized, two-way, normally closed, solenoid shutoff valve features direct actuation, operating pressures to 3,000 psi., a full 1/16-in.-diameter orifice, explosionproof case, and bubbletight sealing characteristics. Ideal for use in pilot plants, test systems, and control circuits, the 600 Series valve uses an actuating principle which opens the poppet even against high pressure with negligible pull required by the solenoid. The valve is available with either nylon or Kel-F poppets to insure tight sealing even with corrosive fluids.

The maker claims that the 1/16-in. orifice permits unusually high flow rates for a valve of this size, with very low pressure drop. Direct actuation involves only two moving parts. Parts replacement can be made without removing the valve from the line. Low amperage, long-life coil is rated for continuous duty

from ALCOA

good designs made better with aluminum



improves process cooling rate, resists corrosion at Southwestern Oil & Refining Company's Big Texas Refinery

Aluminum's superior ability to transfer heat finds practical employment in this Solo-aire cooling installation, made with ALCOA® Aluminum by Hudson Engineering Corporation, Houston, Texas. Light, bright aluminum has other advantages here: notable corrosion resistance and remarkable low-temperature properties. Installed at Corpus Christi, Solo-aire is clear evidence of another good design made better with aluminum. Perhaps ALCOA can help improve your good designs. For more information, please mail the coupon.

ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

Aluminum Company of America, 826-Z Alcoa Building, Pittsburgh 19, Pa.

Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries:

- ☐ 68-10460 Process Industries Applications of Alcoa Aluminum
- ☐ 88-11453 Solving Refinery Corrosion Problems with Aluminum
- ☐ 02-19051 Alcoa Aluminum Handbook
- ☐ 42-20849 Resistance of Aluminum Alloys to Weathering and Resistance of Aluminum Alloys to Chemically Contaminated Atmospheres
- ☐ 34-20437 Aluminum Alloy Heat Exchangers in the Process Industries

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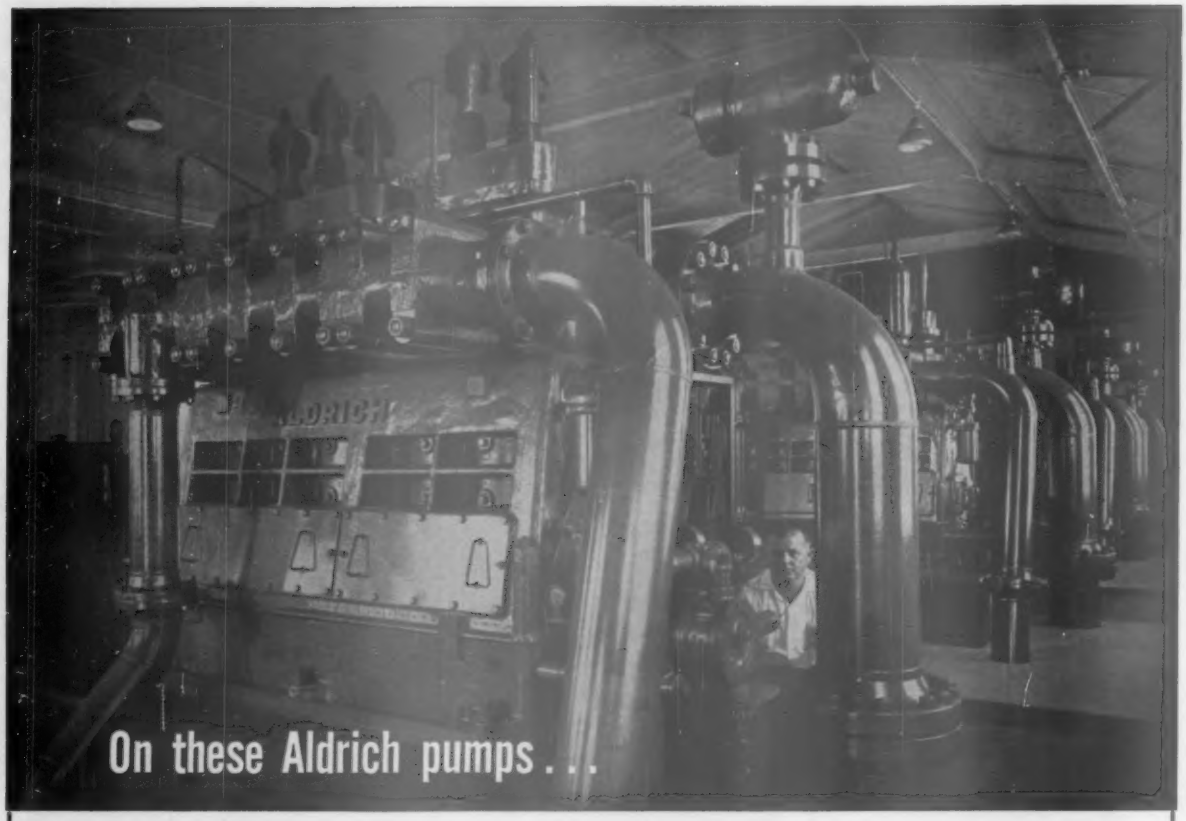
Company_____

Address_____

City_____ Zone_____ State_____



GULF OIL REPORTS 6 YEARS OF CONTINUOUS SERVICE WITH MINIMUM MAINTENANCE

FIELD REPORT

FLOOD: Goldsmith-San Andres Unit
OPERATOR: Gulf Oil Corporation
PUMPS: 4 Aldrich Quintuplex
FLOODING STARTED: October, 1954
EXPERIENCE TO DATE:

After six years, three pumps operate 24 hours a day, delivering some 54,000 bbl/day of sour oil field brine at 750 to 800 psi. Station designed for automatic operation. All maintenance handled by one man during eight-hour work day.

Field Parts stock available in Houston, Odessa, Alice and Wichita Falls, Texas; Casper, Wyo.; Hobbs, N.M.; Carmi, Ill.; Charleston, W. Va., Tulsa, Okla.; Los Angeles, Calif.; Calgary, Ontario. For further information write the ALDRICH PUMP COMPANY, 9 Gordon Street, Allentown, Pa.

the tough pumping problems go to ALDRICH

with either a.c. or d.c. voltages and operates at temperatures from −40° to 160° F. Source: **Circle Seal Products Co., Inc.,** 2181 E. Foothill Blvd., Pasadena, Calif.

•

Master controller for multiple boilers

This new master pressure controller for multiple boiler installations is said to be capable of maintaining steam pressure within ±2% over operating ranges from 15 to 2,000 psi. It uses a K monel bourdon tube as the primary sensing element. The controller operates in conjunction with electronic balanced-bridge-control circuits.

It may contain up to nine master sending potentiometers, enabling it to control nine boilers from a common header. The same controller, with a filled bourdon-tube system primary, may be used as a temperature controller over ranges from 200° to 1,000° F. Source: **Reliance Instrument Div., Electro-Mech Corp.,** 500 Livingston St., Norwood, N. J.

•

New power sprayer

Called the Hayes Jet 500, this portable sprayer is equipped with a weather-proof explosionproof, electric motor. Designed to give high efficiency, reduce labor costs, and provide a broad range of spray applications, the product uses any type chemical, detergent, cleaning compound, or sanitizing chemical—liquid or soluble.

from ALCOA

good designs made better with aluminum

light, strong Alcoa pipe is flow system for first underwater completion well

Peruvian Pacific Petroleum Co. recently made history on several counts with the world's first underwater oil well completion. The flow system (3-in. flow line and ½-in. hydraulic valve control line) is Schedule 40 ALCOA® Aluminum Pipe. Specially fabricated 50-ft sections were welded into continuous lengths and launched through heavy surf and strong currents. During launching, the lines deflected hundreds of feet without rupture. Aluminum provides the flexibility and corrosion resistance for all types of pipelining. No need for costly coatings or wrappings to resist the ravages of marine corrosion. For more information about ALCOA pipe, please send the coupon.

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ALUMINUM COMPANY OF AMERICA

Aluminum Company of America, 826-ZZ Alcoa Building, Pittsburgh 19, Pa.

Please send me the following literature covering Alcoa Aluminum for tubular products and other uses in the process industries.

- ☐ 34-10197 *Aluminum Pipe and Fittings*
- ☐ 34-11346 *Alcoa Unistrength Pipe*
- ☐ 34-21113 *Hill Top Pipeline Installation Tests New Pipe-Laying Techniques*
- ☐ 89-21203 *First Underwater Well Completion Made*

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

control scale problems

with these Dowell products

Most scale problems in oil and gas wells can be controlled with the Dowell products listed here. These products can help you increase production, hold down workover costs.

BULK ACID

Inhibited hydrochloric acid used to remove a variety of scales from formation faces, tubing and water or oil flow lines.

INSTANT ACID

Dowell acid in granular form. Add water and it's ready to use. Convenient where transportation or storage of bulk acid is a problem.

VERSENE® 100

Versene 100 chelating agent is used to remove difficult scale deposits, including calcium, magnesium and barium sulfate.

GYPBAN*

Gypban, Dowell material used to prevent formation plugging by water-formed gyp deposits, is granular in form. It is injected into producing wells with water or fracturing materials. It is also used to maintain flow in injection wells by keeping scale deposits from forming in lines and in the well.

Call your nearest Dowell representative for full information.

*DOWELL TRADEMARK

PRODUCTS FOR THE OIL & GAS INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

The maker says the sprayer provides a fast, safe, and effective high-pressure method for onsite cleaning of rigs, drilling machinery, and tools without their removal from the field. Other applications include maintenance cleaning in refineries, tank farms, repair and machine shops, and warehouses. The sprayer requires only one man for operation. After use it can be cleared of chemicals by running a water rinse through the machine. Source: **Hayes Spray Gun Co.**, 98 W. San Gabriel Blvd., Pasadena, Calif.

●

Gas-powered diaphragm pump

Capacities in this series of pumps range from 1,000 to 17,000 g.p.m. Suction and discharge openings range from 2-in. single on the Model 2D-8 to 4-in. double on the 24D. The pump's worm-gear drive provides a one-step speed reduction, eliminating the need for an intermediate speed reduction on either the power source or the pump.

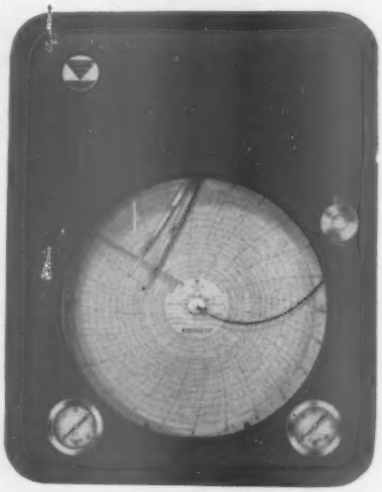
Worm and worm gear operate in a constant bath of oil. The larger, double-diaphragm pump is powered by a 9-hp. gas engine. Other features include quick-change adaptors for hose connections, bronze-bushed banjo-type eccentrics, cleanout ports on both suction and discharge sides, and compact design for easy handling on the job. Source: **Rice Pump & Machine Co.**, Belgium, Wis.

●

100-watt VHF mobile radio set

The Slimline Model 6N100/SLT radio combines a compact under-dash transmitter-receiver unit with

SERIES A-88 CONTROLLERS



Designed to give rugged, dependable performance, American® Series A-88 Controllers provide versatile, positive control of... Flow, Pressure, Liquid Level and other continuous process variables...accurately and automatically.

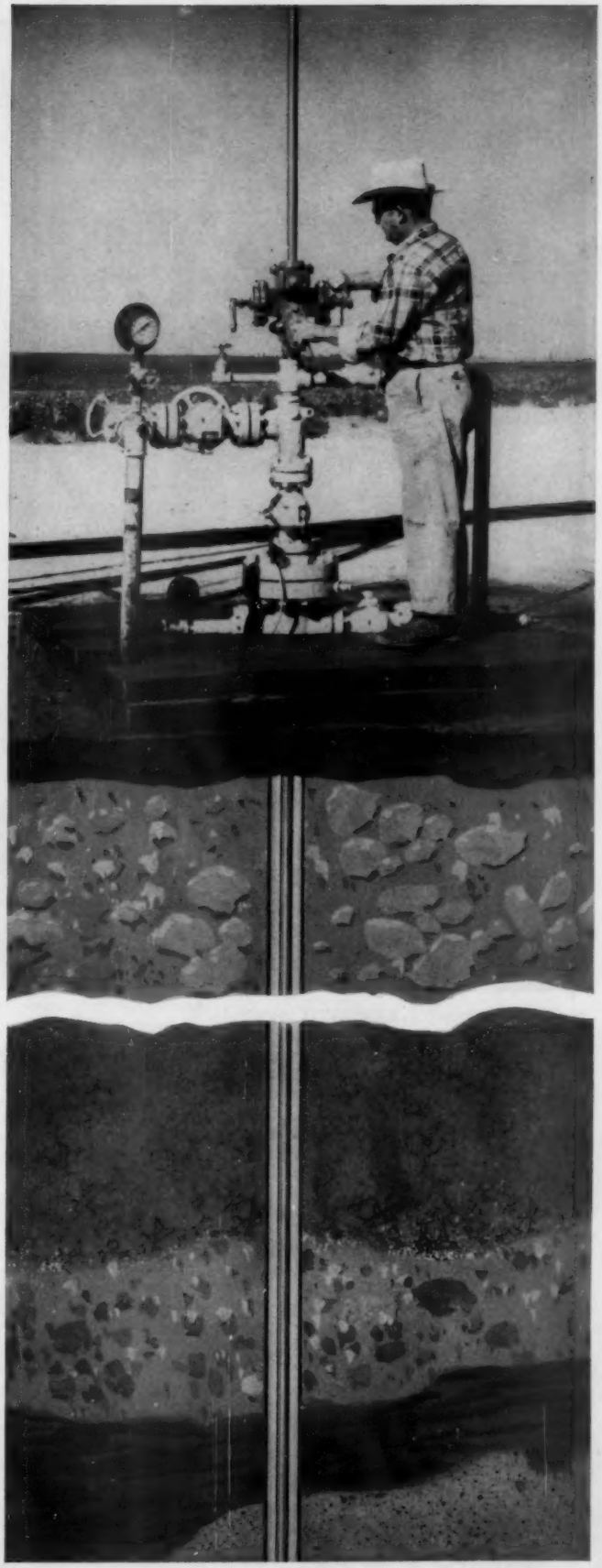
- Rugged, null-type, non-bleed Relay.
- Simple, in-the-field linkage adjustment.
- Maximum Proportional Band changes with minimum output pressure changes.
- Proportional Band easily widened without disconnecting instrument tubing.
- Spring-closing Reset Valve sealed with bellows and calibrated according to time.

Ask for Bulletin 406.

AMERICAN METER COMPANY

Sales Offices in Principal Cities

Nickel steel rods fight corrosion fatigue... pumping sour crudes at 30,000 psi



Corrosion fatigue was causing carbon steel sucker rods to fail at Cosden Petroleum's operation near Big Spring, Texas. They pump sour crudes with a chloride content of 30,000 ppm. 'Way down at 7,500 feet, stresses reach 30,000 psi.

Outstanding resistance to corrosion fatigue of AISI 4620 nickel alloy steel rods was the big reason why Cosden chose them to replace their carbon steel rods. Result? After three years' service, the nickel steel rods are still in excellent condition. Cosden expects many more years of trouble-free service from them.

For cost-saving heavy-duty pumping in corrosive conditions, remember this when you order sucker rods. AISI 4620 nickel alloy steel sucker rods provide—

- High mechanical properties, assuring stiffness needed in long strings and enabling rods to withstand the high stresses of deep-well pumping.
- Good staying power in a wide range of corrosives.

Great strength, ductility, toughness, corrosion resistance — AISI 4620 combines them all to stand up to high cyclic stresses and sour crude corrosion fatigue.

Nickel alloy steels give outstanding performance in other petroleum-production equipment. For drill pipe, hole reamers, in fishing taps and slip liners, in pumps and sucker-rod couplings — nickel alloy steel parts are your best insurance against equipment failure.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO New York 5, N. Y.

INCO NICKEL

NICKEL MAKES STEEL PERFORM BETTER LONGER

Exclusive LUFKIN Chrome Clad® lines won't rust, chip or peel

The bold, black markings are bonded to steel . . . protected by layer on layer of electroplating . . . topped by a final coat of chromium!

Exclusive quality features are yours in all Lufkin tapes. For example:

Lufkin "Atlas" Gaging Tape (above, left) is easy to read with durable, jet-black markings on glare-free, chrome-white line. Extra *sturdy* line, 50% heavier than standard weight. 20-ounce plumb bob. Lock-handle frame.

Lufkin Chrome Clad Anchor Tape (above, right) is available with easy-to-read markings in feet, tenths and hundredths, in genuine-leather, hand-stitched case. The handiest thing you can carry, on job after job.

See your Oil Supply House.

Measure for measure, the finest made...

LUFKIN

SAGINAW, MICHIGAN

NEW EQUIPMENT

a high-powered amplifier unit placed in the trunk or other convenient location. Only one small coax cable is needed to connect the two units. The Model 7N100/SLTA for low-band operation is also available.

The underdash unit weighs less than 9 lb., the amplifier less than 14 lb. Both are transistor-powered and constructed of heavy-gage aluminum. Carefully hand-wired circuitry is used throughout. A feature of the new product is its ability to update any equipment in the 10 and 30-watt category by simply adding the 100-watt amplifier unit alone. The amplifier can be used with any FM mobile radio equipment to provide a full 100-watt output. Source: **Aeronautical Electronics, Inc.,** Box 6527, Raleigh, N. C.

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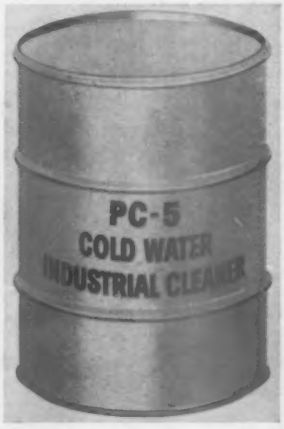


Cold-water cleaner

Called PC-5, this universal cold-water cleaner is said to be highly effective for removal of greases, guns, and oils. It's nontoxic upon inhalation, gives off no odor, is harmless to skin and clothing, and is noninflammable. The maker reports that the cleaner will not affect painted surfaces and contains an antioxidant for maximum protection of metal.

The concentrate is designed to be cut 10 parts water to one part chemical for normal cleaning operations. Suited to plant safety-maintenance programs, the cleaner may be applied freely with brush, cloth, or any type spray device for grease-free stairways, floors, and equipment. Source: **Davis Emergency Equipment Co.,** 45 Halleck St., Newark 4, N. J.

FACTS FOR REFINERS

PSD

INSTRUMENTATION FOR AUTOMATION

Five Keys To More Profit

• NEW PSD CONTINUOUS VISCOSIMETER Helps Refiners Make Present Equipment More Productive, Increase Yields, Upgrade Low-Value Stocks, Improve Quality, Cut Indirect Costs

Accurate and automatic measurement of viscosity on process streams can significantly speed many refining operations, improve product quality and conserve blending materials. The PSD CONTINUOUS VISCOSIMETER* is accurate to 0.5% of scale over the viscosity range of 30—2500 SSU and temperatures from 100-210° F. For more viscous materials, such as asphalt, extended ranges of viscosity and temperature can be supplied.

The CONTINUOUS VISCOSIMETER is fully automatic, truly continuous, compatible with electronic controllers and designed for Class I, Group D, Division 1 installation.

Major Profit Advantages

1. *Makes Present Equipment More Productive* . . . For crude-running units the PSD CONTINUOUS VISCOSIMETER keeps distillates *on specification* . . . resulting in more *usable* products. It continuously saves production time by getting units "lined-out" faster after changes in operations. For continuous blending and packaging operations, the instrument eliminates the production delays associated with laboratory testing and reporting.

2. *Helps Get Higher Yields* . . . For crude-running units the CONTINUOUS VISCOSIMETER provides more accurate control of distillate quality, reduces diversion of distillates to gas oil, increases utilization of crude for valuable products. For deasphalting and dewaxing processes, the instrument helps segregate products accurately—prevents degrading the value of end products. For packaging operations, continuous viscosity monitoring prevents the loss of final product due to contamination.

3. *Increases the Value of Low-Grade Stock* . . . In the blending of residual fuels the CONTINUOUS VISCOSIMETER helps you capitalize on maximum use of less-costly cycle stocks.

4. *Helps Make Better Quality Products* . . . For blending operations the PSD CONTINUOUS VISCOSIMETER maintains products consistently within specifications. Continuous viscosity measurements of laboratory accuracy reliably aid operators to eliminate peak and valley variations in quality.

5. *Reduces Indirect Costs* . . . In all refining operations the PSD CONTINUOUS VISCOSIMETER considerably reduces the need for reprocessing—through more accurate control at each refining step. It reduces the amount of storage capacity required. It speeds the release of product shipment through "on-the-spot" monitoring of product quality.

HOW IT WORKS . . . Sample is furnished continuously from the process line or vessel to the CONTINUOUS VISCOSIMETER, where it is brought to test temperature by flowing through a heat exchanger immersed in the constant temperature bath. Sample then passes through a pressure regulator to a constant-rate metering device that is also immersed in the bath. Under these conditions of constant volumetric rate and temperature, the pressure exerted by the sample at the entrance to the measuring capillary is proportional to the viscosity of the liquid. This pressure is sensed by a strain gauge having an accuracy of ±0.25%. The signal from the strain gauge is recorded in convenient viscosity units, either Saybolt Seconds or centistokes, as specified.

*Developed by Standard Oil Co. (Ind.)—manufactured under exclusive license by Precision Scientific Development Co.

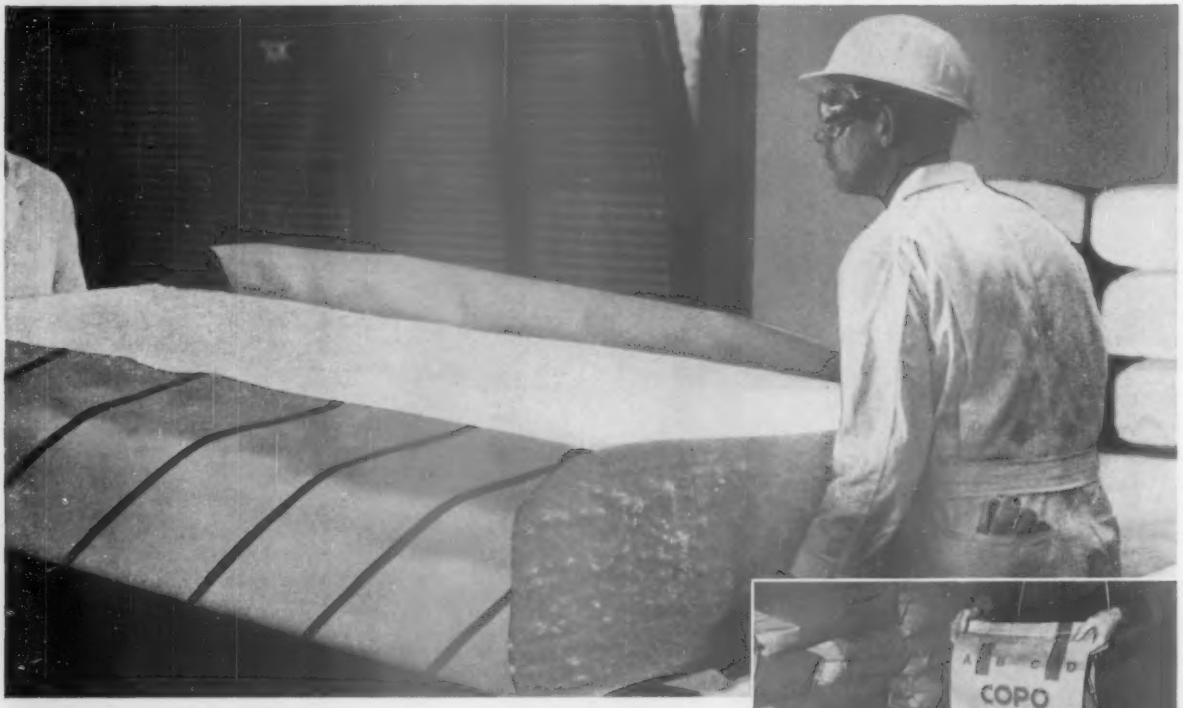
Write for your copy of Bulletin No. 706. Get complete information on this new, profit-building automatic instrument

PSD **Precision Scientific Development**

3745 W. Cortland St. Chicago 47, Ill.

SILICONE NEWS from Dow Corning

Stop sticking / start saving



Syl-off coated papers speed unpacking, simplify handling of sticky products

Recognize this problem? The product sticks. So does production. Handling costs go up. Lost time and product waste run high. If this is a problem to you, it needn't be.

Here's a solution. Specify packaging and processing papers coated with a Syl-off® silicone release coating. Even the toughest stickers—asphalt, adhesives, dried fruit, plastic bases, polyurethane, raw rubber—come away cleanly and quickly from all types of containers and process papers coated with Syl-off. Nonmigrating and noncontaminating, these anti-adhesive silicone coatings aid processors in removing all the product, keep production moving smoothly, and hold product waste to a minimum.

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You benefit. Whether you buy, ship, or handle sticky products during your process operations, there's a Syl-off coated paper to solve your sticking problems . . . produce extra profits. Investigate now.

For detailed data plus a list of sources of Syl-off coated papers, write Dow Corning Corporation, Dept. 8824a, Midland, Mich.

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TRADE LITERATURE

Fabrication services

Just published, this 36-page booklet gives a behind-the-scenes picture of machinery, tools, materials, techniques, and quality-control procedures used in the fabrication of tanks, pressure vessels, and other plate-fabricated equipment. It presents numerous examples of products in a variety of sizes, shapes, and metals. The booklet includes detailed corrosion-data charts, showing the corrosive effects of almost 400 salts, acids, and other materials in 16 different types of metals and alloys. Source: **Nooter Corp.,** 1450 S. Third St., St. Louis 66, Mo.

Steel buildings

Brochure RFB-761 (24 pages) promises to answer questions about the adaptability of rigid-frame steel buildings to suit your personal needs. In it are some unusual examples of steel buildings, details of structural features to look for, facts about construction, expansion, and insulation, and architectural and economic advantages. Source: **Columbian Steel Tank Co.,** 1509 W. 12th St., Kansas City 1, Mo.

Catalyst-protection hardfacings brochure

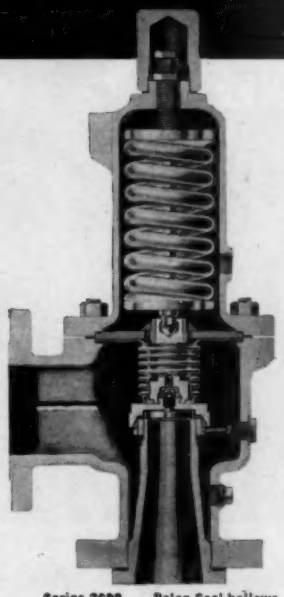
Featured in this four-page brochure are Tapco applied facings, said to meet or surpass all existing specifications for catalyst-protection hardfacing. A full page of advantages and features is presented, along with data on components and recommended uses. Source: **Texas Alloy Products Co.,** 1403 N. Post Oak Rd., Houston, Tex.

Welding fittings

Bulletin TF-510 covers 90° elbows, long tangent one end or both ends, in standard weight and extra strong. The term "long tangent" refers to a short extension of the face tangent to the 90° point of the elbow. Its purpose is to provide a straight section on which a slipon flange can be fitted for welding. The four-page booklet includes charts on all pertinent dimensions in a nominal pipe size range of 1½ through 12 in. Wall thicknesses agree with

value...

the reason FARRIS OUTSELLS all others



Series 2600 . . Balan-Seal bellows. 150 to 6000 psig. Also without bellows.

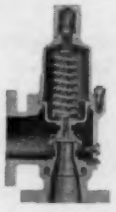
Farris Process Safety-Relief valves have unique design features which provide product serviceability and dependability unmatched by *any* competitive valve. True value is "built into" Farris valves.

- **2½ to 1 ratio—guide length to guide diameter—prevents galling and hanging up.**
- **High thermal expansion of sleeve guide and low thermal expansion of hardened stem retainer stops binding at high temperatures.**
- **Hardened stainless steel optically lapped disc . . . self aligning for maximum tightness.**
- **Elimination of effects of back pressure by "BALAN-SEAL" bellows permits use of smaller discharge piping . . . Saves up to 15 times the cost of the valves . . . isolates internal working parts from lading fluid.**
- **Industry's most complete line. Available in cast iron, steel and special materials. Sizes ½" to 8". Pressures to 10,000 psig. Temperatures to 900°F. Enclosed or exposed springs. Plain, open lever or packed lever construction.**

All Farris Nozzle Valves Conform To ASME Power Boiler Code, Section 1, and The ASME Unfired Pressure Vessel Code, Section 8.

Series 2740 & 2741 . . . simple, rugged cast steel design. Pressures to 5000 psig @ 750°F.

Series 2745 . . . Durable, compact, high pressure nozzle valve. Internal parts 316 stainless steel. Pressures to 10,000 psig.



Series 2950 . . . Cast iron valve similar to Series 2600. Max. pressure 250 psig. @ 450°F, 400 psig. @ 150°F.

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GET FULL VALUE: Replace With Farris...Complete Interchangeability With Standardized Face To Face Dimensions.

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AFFILIATES: Farris Combustion Controls Corp. • Farris Flexible Valve Corp. • Farris Universal Machine Corp. Farris Industries Canada Ltd. • Farris Engineering Ltd., London, England

Have You Tried a RIDGID® Hex Wrench Yet?

Six Sizes with Maximum Jaw Openings of 1⅛", 1½", 1¾", 2½", 3½" and 4⅞" across flats.

the Perfect Mate for your RIDGID Pipe Wrench!

Finest of All Adjustable Smooth-Jaw Wrenches

MORE GRIPPING POWER... for all nuts. Puts a wrap-around grip on hexes that just won't slip. Because you're pulling with at least three flat sides at once, you'll never round off shoulders. Works on square nuts, valve packing nuts, unions and gas cocks and flat shapes, too. Smooth jaws won't even mar polished or plated surfaces.

RUGGED CONSTRUCTION... built good and solid. Thin but extra-strong jaws slip into tight places. The first time you use a hex wrench you'll know that here's a wrench you'll use for a long, long time. It's every bit as rugged as your familiar RIDGID Pipe Wrench.

RIDGID No. E-110 Offset Hex Wrench

Big Jaw, Short Handle for Sink and Tub Drain Nuts

Maximum Jaw Opening—2⅛" across flats.

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From experience you know it's easier to work with the best of tools. Order your RIDGID Hex Wrenches from your Supply House today!

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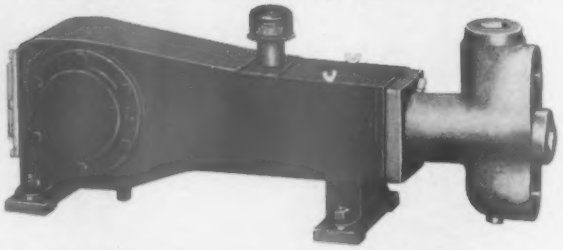

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AFTER SEVERAL YEARS of field testing, HARLEY SALES COMPANY now offers the first heavy duty HIGH PRESSURE, low volume salt water pump.

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- 7½ horsepower maximum.
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Call us today — DELIVERY TOMORROW on all types of salt water or crude oil pump requirements.

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REDA PUMP CO.
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Manufacturers of submergible motors and pumps for over 35 years — for oil, brine and water — with gasoline and jet fuel

ASA B36.10 and dimensional tolerances are according to ASA B16.9. Source: **Tubular Products Div., Babcock & Wilcox Co.**, Beaver Falls, Pa.

Quick-connect fluid couplings

Two new publications, Catalog C-3001 and Catalog C-2101, introduce the Roto Lock and Trigger Lock fluid couplings. Both eight pages, the publications include mechanical data, charts showing pressure ratings and interchangeability of sockets and nipples, and information on selecting couplings. Source: **Jack & Heintz Div., Siegler Corp.**, Box 6719, Cleveland 1, Ohio.

Gas-meter booklet

In 12 pages, this booklet outlines advantages and design of the V-175 and V-250 gas meters, with capacities of 175 and 250 cu. ft. per hour. Besides technical information, the booklet lists parts, accessories, and variations obtainable. Source: **Arkla Meters Div., Arkla Industries, Inc.**, Russellville, Ark.

Fluorosilicone fluids, greases, compounds

Technical literature on fluorosilicone fluids (Bulletin 15-200), greases (Bulletin 15-201), and compounds (Bulletin 15-202) has been made available. The publications contain properties and performance charts and graphs, along with suggested applications for these new solvent, fuel, and chemical-resistant materials. Source: **Dow Corning Corp.**, 592 Saginaw Rd., Midland, Mich.

Proportioning pumps

Bulletin 861 describes a complete line of proportioning pumps including the recently introduced Strokontrol series. The 12-page bulletin includes capacity and selection tables and a detailed description of the operation of Strokontrol's hypocycloidal gear arrangement. The publication presents pumps with maximum capacities from 1.83 to 1.472 gal. per hour and for pressures to 6,500 psi. Metering accuracy is ±0.5%. Source: **Jaeco Pump Co.**, Villanova, Pa.

Strahman

HIGH PRESSURE GAUGES

FOR CHEMICAL PLANTS AND REFINERIES

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Single or Multiple Sections

Multiple section gauges are made with a one piece body chamber. This method of construction, originated by Strahman, has become generally adopted as standard by most gauge manufacturers.

An added safety feature! Except for visibility slot, glass is completely enclosed.

- Explosion proof illuminators
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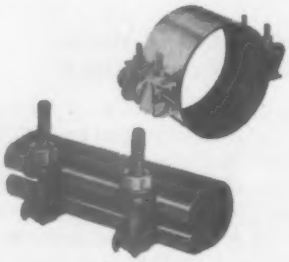

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All the pipe joints you need for fast installation on tank batteries, gathering lines, mud pumps, salt-water disposal lines . . . now in stock at your supply store.

All the easy-to-install, permanent repair products that enable you to stop leaks fast . . . now in stock at your supply store.

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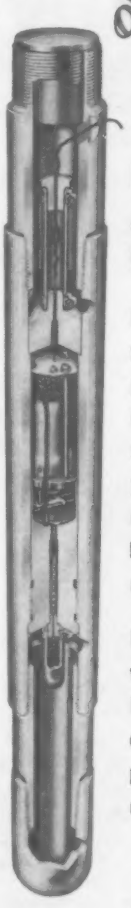

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Pressure Sentry MK-7, permanently installed below pump, sends digital signals up a single wire to portable surface unit. Accurate pumping, buildup, and drawdown pressures may be recorded continuously or at predetermined intervals.

Reliable flowing and gas well pressure information is available since the transducer is below the tubing perforations and does not restrict fluid flow.

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EQUIPMENT MEN

Homer R. Swift joins Coates Field Service, Inc. as veep

Swift recently retired from Service Pipe Line Co., Tulsa. He joined the company in 1931 as a right-of-way and claim agent. In 1939 Swift became superintendent of right-of-way. During his 21½ years with Service, he supervised the acquisition of more than 9,500 miles of right-of-way.

Galvanizers' international awards winners announced

The first two of 10 international awards of $1,000 each, offered by the American Hot Dip Galvanizers Association in cooperation with the American Zinc Institute, were announced at the AHDGA semiannual meeting in St. Louis.

Earl H. Lenz, of Buffalo Forge Co., Buffalo, N. Y., received his award for a method for the manufacture of housings, using a spot weld and sealer in assembly and prior to galvanizing to avoid distortion and warping from continuous seam welding. Ralph D. Barer, consultant engineer of British Columbia, received his award for an idea for the substitution of forged and galvanized steel clamps for scaffold construction to retain the strength of steel, and eliminate the uncertainties of performance of lighter metals.

Electric Machinery Mfg. names Gelinas, Murnane to new posts

Horace Gelinas has become manager of manufacturing and a member of the management committee for Electric Machinery Mfg. Co., succeeding G. W. Sjoquist. Gelinas is a 35-year veteran of Electric Machinery's manufacturing department.

J. E. Murnane has been named manager of materials, a new position. Formerly director of purchases, Murnane has been with the company for 10 years. The new position combines all external procurement with material processing.

Process-control department established at Perkin-Elmer

A new product department to handle process-control instrumentation has been organized by the Instrument Division of Perkin-Elmer Corp. Horace G. McDonell, formerly sales manager of the Instrument Division, was named department manager.

INTERNATIONAL NOMAD GUESTS at the recent meeting of the Los Angeles chapter were (front row, from left): Barney Horan, Camdrill, from Libya; George O'Neill, Tipton & Kalmbach, from Pakistan; and Charles Augustus, Santa Fe Drilling, from Trinidad. In the back row are: Walt Attlesay, Drillex, from Argentina; and E. L. Pierotti, Sydney Broom, and J. A. Wilkinson, all of Camdrill, from Libya.

Lone Star Steel approves plans for $20 million extrusion mill

E. B. Germany, Lone Star's board chairman, announced that the mill, which will produce high-test seamless pipe, will be built at the company's present plant in Morris County, Texas. In addition to pipe for deep wells and other installations, the mill will produce various other grades of pipe including rounds, squares, and shapes for construction use.

Germany noted that the new mill will not supplant production of electric-weld casing, tubing, and line pipe, but will add another 300,000 tons to the company's present annual capacity.

Wilson Supply Co. makes two changes

Roger C. Clark has joined Wilson Supply as a city salesman in the Tulsa office, replacing J. G. (Grady)

R. C. Clark

J. G. Ferguson

Ferguson, who is returning to the general offices in Houston. Clark formerly worked 3 years in various oil areas as a sales and service engineer for a mud company. In his new assignment at Wilson, he will be working with oil companies and contractors on their equipment, service, and supply problems.

Ferguson will become Wilson's personnel director. He has been with the company since 1946, and before going to Tulsa in 1958 as city salesman, had worked in all major departments in the home office.

MMM buys valve business from Cooper Alloys Corp.

Executives of Manning, Maxwell & Moore, Inc., Stratford, Conn., and Cooper Alloys Corp., Hillside, N. J., have announced that Manning has agreed to buy Cooper Alloy's valve and fittings business and re-

No. 3 PROGRESS REPORT TO PIPELINERS:

Developments in eddy current inspection of line pipe

Republic has advanced the art of electromagnetic testing through development of a dual, sonic-electromagnetic system for production line inspection of line pipe.

A new testing coil assembly (left) has been especially developed for line pipe. It makes line pipe inspection 100 times more reliable than the initial tests in 1955. The problem of electrical skin effects—which impedes the entry of eddy currents deep into thick walls—has also been solved through research in electromagnetic testing frequencies.

Now in daily operation, Republic's new, fully automatic sonic-electromagnetic equipment has tested hundreds of tons of Republic Electric Weld Line Pipe. This equipment should be in operation on all Republic pipe mills in the near future.

Republic has demonstrated equal capability in both systems. Republic chooses between sonic, electromagnetic, or a combination of both to give you the maximum reliability—to give you the greatest possible line pipe safety and economy.

Steel

Strong
Modern
Dependable

REPUBLIC LIGHT WALL LINE PIPE (BLACK) PLAIN END

Size O.D.	Weight Per Ft.	Wall Thickness	Test Pressures PSI Grade A	Grade B
1.315	.868	.065	1800	2000
	1.092	.083	2300	2500
	1.403	.109	2500	2500
1.660	1.107	.065	1400	1600
	1.398	.083	1800	2100
	1.805	.109	2400	2500
1.900	1.274	.065	1200	1400
	1.611	.083	1600	1800
	2.085	.109	2100	2400
2.375	1.60	.065	1000	1100
	2.03	.083	1300	1500
	2.64	.109	1700	1900
2.875	2.47	.083	1000	1200
	3.67	.125	1600	1800
3.500	3.03	.083	900	1000
	3.46	.095	1000	1100
	4.51*	.125*	1300	1500
	5.58*	.156*	1600	1900
	6.63*	.188*	1900	2200
4.000	3.47	.083	700	900
	3.96	.095	800	1000
	5.17*	.125*	1100	1300
	6.40*	.156*	1400	1600
	7.65*	.188*	1700	2000
4.500	3.92	.083	700	800
	4.47	.095	800	900
	5.84*	.125*	1000	1200
	7.25*	.156*	1200	1500
	8.64*	.188*	1500	1800

*Sizes made to API Standard 5L, latest edition.
All other items are manufactured to applicable parts of API Standards 5L, latest edition.

REPUBLIC LIGHT WALL saves you up to ½ the weight, up to ⅓ the cost. Of special interest for low pressure gathering and distribution applications, this pipe is available in 1.315″ through 4.500″ O.D. Republic X-TRU-COAT Plastic-Coated Steel Pipe is available in all light wall sizes. Contact your nearest Republic representative or mail the coupon on the following page for complete information.

REPUBLIC STEEL

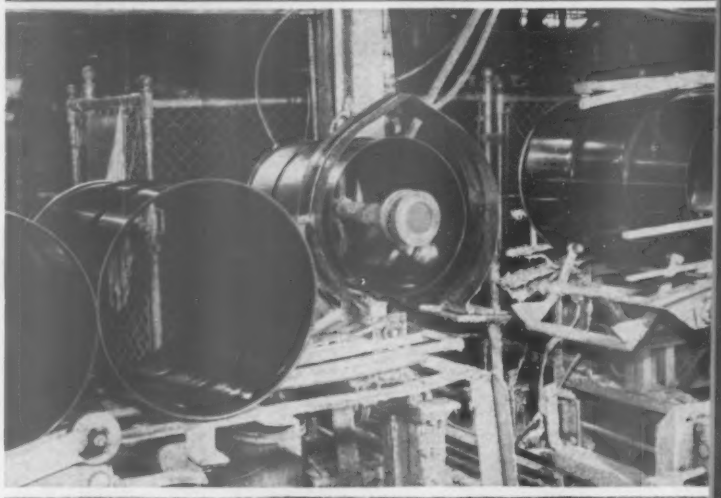
Cleveland 1, Ohio

Electric Weld • Seamless • Continuous Butt Weld • X-TRU-COAT
Plastic Pipe • Light Wall • Fusion Weld

FOR GREATER RELIABILITY...

PRESSURE THAT NEVER RELAXES— Republic NYLOK® Self-Locking Nuts assure maximum *permanent* holding in any application. Nylon inserts firmly staked into the nut exert a spring-like wedging action against opposite mating threads, won't let nuts back off, even under severe vibration. Here, clamping force will be even greater after extended service, due to tendency of the nylon insert to grow into opposite threads. Important too, nylon inserts in Republic NYLOK Nuts (and in NYLOK Bolts, too) are unaffected by moisture, age, solvents, or temperatures ranging from 250° to −70°F.

ELECTROSTATICALLY LACQUERED DRUMS available from Republic assure peak protection for your product. In Republic's ELECTRO-LAC Process, a fine lacquer mist is dispersed from a high speed distribution head. This mist is uniformly attracted (as a result of an electrostatic field produced in the drum) over the entire interior. Thin spots in the coating are eliminated. Ask your Republic Container salesman for details or mail the coupon.



A BETTER PIPE FOR SOUR CRUDE— Republic SRK® Plastic Pipe has been used for more than three years by the R. S. Anderson Oil Company, Midland, Texas. In lines once replaced every six to eight months, SRK is still in service. Anderson reports no corrosion, no evidence of chemical action in general, very little damage from abrasion. Savings—already estimated at 50%—continue to grow. Republic SRK is available in a wide range of pressure ratings and sizes from ½″ through 8″. Return coupon for data.

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REPUBLIC STEEL

REPUBLIC HAS THE FEEL FOR MODERN STEEL

lated assets. The Foundry Products Division and Vanton Pump & Equipment Corp. will continue to be operated by Cooper Alloy.

Cooper's Foundry Products Division specializes in castings of stainless steel and other heat and corrosion-resistant alloys. Vanton Pump & Equipment, a wholly owned subsidiary, manufacturers centrifugal and specialty pumps of plastics and stainless steel.

Patrick Adamson elected veep of Wheel Trueing Tool Co.

Patrick Adamson

Adamson's election was announced by Harold E. Robison, president of the Detroit - based industrial and diamond-tool manufacturing organization. Adamson has been active in the company's diamond drill - bit manufacturing and marketing operations for 20 years. He will continue to handle some of those responsibilities in addition to his new duties.

Eastman Chemical Products sets up Dallas chemical sales office

A chemicals division sales office has been established in Dallas by Eastman Chemical Products, Inc., subsidiary of Eastman Kodak Co. Located at 425 Braniff Building, the office will be headed by William L. Rutherford, assigned as sales representative. Rutherford moves to Dallas from the company's sales development laboratory in Kingsport, Tenn.

Midwest Piping Div. of Crane assigns Veigel to new position

Donald W. Veigel has been named manager of engineered products for Midwest Piping, a division of Crane Co., it was announced by E. B. Stolle, Midwest's general manager in St. Louis. Named as assistant to Veigel was S. G. Ramsey, Jr. Also appointed were Herman Kost as

● *Johnston Vertical Pump Case Study:*

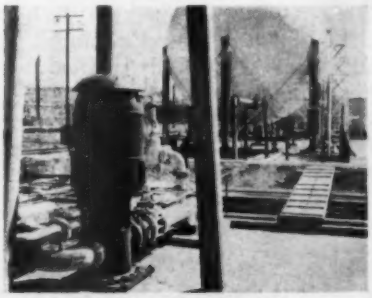
Mobil Oil Refinery, Torrance, California

The Mobil Oil Refinery in Torrance, California, has a capacity of approximately 100,000 barrels per day. Practically all processes in the refinery produce light hydrocarbons which are gathered and fractionated into several relatively pure components. These components, which include normal butane, are pumped to spherical pressure vessels for intermediate storage.

From the pressure vessels the butane is pumped to the tank farm to be blended into gasoline or to LPG trucks for delivery to customers.

Johnston Pump 5-year Record

Of all the Johnston pumps in light hydrocarbon service in this Mobil Oil Refinery, the Johnston that pumps liquified butane from the pressure vessels to the tank farm, one-half mile away, is probably most used. This pump has not been pulled for maintenance for more than 5 years.



Johnston 50 HP Pump Between Pressure Vessel and Tank Farm

More Johnston Verticals

Johnston has a reputation in the industry as a specialist in vertical pumps. The 50 HP mentioned above is called in the industry a Butane Blending Pump. It is basically a transfer pump.

Specifications are given in Fig. 1 together with other Johnstons, one or more of which are at work for Mobil Oil in Torrance. The schematic (Fig. 2) shows the method of transferring the butane, but it doesn't include the two 5 HP units listed in the specifications. These two Johnstons are a part of the TCC process installation. They are in continuous operation, pumping water containing a high percentage of H_2S away from the gasoline accumulator.

#1–Barrel Pump • 700 gpm capacity • 284 ft. head • 50 hp. • 6 stage, 12 BC bowl assembly
#2–Barrel Pump • 100 gpm capacity • 1200 ft. total dynamic head • 30 hp. • 20 stage, 6 AC bowl assembly
#3-4–150 gpm capacity • 290 ft. head • 7½ hp. • 14 stage, 7 CC bowl assembly
#5-6–62 gpm capacity • 144 ft. total dynamic head • 5 hp. • 3 stage, 6 AC bowl assembly

FIG. 1

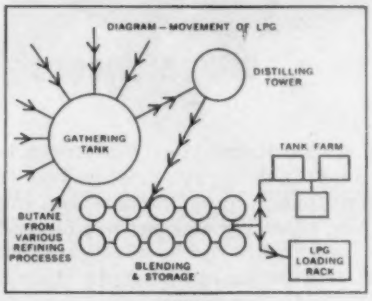


FIG. 2

Johnston pumps have been dependable servants of the oil industry for many years in refineries, pipe lines, water supply and injection service for secondary recovery and offshore work.

A trained Johnston field man will be glad to give you complete information or show you how Johnstons can best serve in your operation. There is a Johnston field man located in your area. A call to the Factory or branch nearest you will put him in touch with you within a few days.

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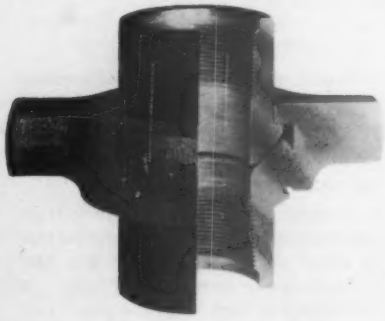

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manager of construction in the central states area, and L. K. Johnson as manager of fabrication engineering for the St. Louis plant. With headquarters in St. Louis, Veigel will supervise piping fabrication and erection operations for the division.

R. A. Schlegel becomes prexy of Republic Flow Meters Co.

R. A. Schlegel

R. A. Schlegel has been appointed president of Republic Flow Meters Co., a subsidiary of Rockwell Mfg. Co., according to W. F. Rockwell, president of the parent company. At that time W. F. Crawford will relinquish the presidency, but will continue as a director of Republic. Crawford is also president of Edward Valves, Inc. and vice president of Rockwell Mfg.

Schlegel goes to Rockwell from Daystrom, Inc., where he was vice president and general manager of the Weston Instruments Division, Poughkeepsie, N. Y. Prior to joining Daystrom in 1956, he was with Minneapolis - Honeywell Regulator Co. for 19 years in various marketing capacities.

CF&I names representative

Charles F. Breinig, Jr., has been appointed sales representative, wire - rope products, for Colorado Fuel & Iron Corp.'s Oklahoma district. His headquarters are located in Oklahoma City. Breinig became associated with CF&I in 1953, starting in wire-rope sales at the Denver general offices.

He transferred to the price approval department of CF&I's Pueblo, Colo. plant in 1955, going to Salt Lake City 2 months later as a specialty products sales representative. In 1959 Breinig went to Spokane as wire-rope sales representative, transferring to specialty products in January 1961 in the same capacity.

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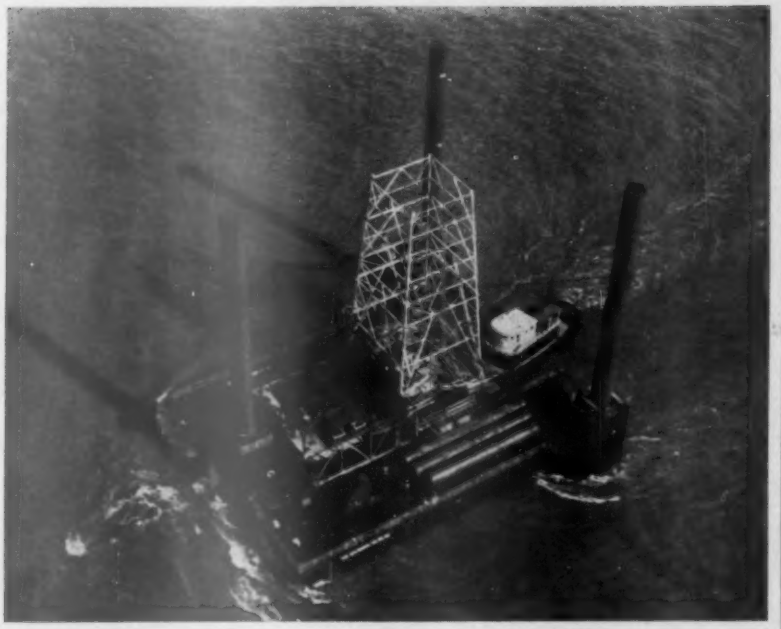

HERE'S the deep-water drilling unit that is now making hole in offshore waters of Gabon Republic in West Africa. When this picture was taken, the unit was rigging up its 140-ft. derrick.

Gabon drilling started

THIS has been a good year for the small Republic of Gabon on Africa's West Coast. With two discoveries already this year, an ambitious drilling program is under way.

The equipment being used is different, too. In the picture above, the Offshore Co.'s Rig 59 drilling barge is a square-shaped three-legged unit. Designed for depths of water greater than 100 ft., the barge has a raked bow to counteract the effects of heavy weather and increase its maneuverability. It is 108 ft. long, has an 80-ft. beam and a hull depth of 12 ft. Its draft is only 4½ ft.

The legs allow the unit to be self-elevated. This is the second craft of this design in the firm's fleet. Another three-legged unit—Rig 58, the prototype—is drilling off the coast of British Honduras in the Caribbean Sea.

Both the rig and its tender were towed to the Dark Continent from the Gulf Coast this summer. The companion vessel, Offshore's Tender No. 3, is 260 ft. long, 48 ft. across its beam, and has a hull depth of 15 ft. Normal draft is 9 ft., but this will vary depending upon the tonnage carried.

Rig 59 is drilling for Offshore International, S.A., a subsidiary of the Offshore Co. of Baton Rouge, and is under contract to Mobil International Oil Co. and a French firm, SPAEF (Ste. des Petroles d'Afrique Equatoriale Francaise).

A base camp has been set up near Cap Lopez, the westernmost part of Gabon. Formerly a part of French Equatorial Africa, Gabon formally became an independent republic in July 1960.

The rig was fabricated at McDermott Fabricator's Bayou Boeuf yard in Louisiana. The platform's legs are self-jacking and are 200 ft. long.

Mobil International, through two of its affiliate companies, Mobilrex and Mobil Exploration Equatorial Africa, Inc., has a 50-50 interest with SPAEF in more than 6,000,000 acres in Gabon and in Middle Congo. More than half this total acreage is in Gabon.

The Mobil companies plan to spend between $22.5 and $45 million during a 5-year period which began 3 years ago. The blocks of

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acreage jointly held by Mobil and SPAEF include onshore and offshore leases.

The two strikes that have been found during the year occurred near Port Gentil and at Pointe Weze. The Port Gentil strike was the SPAEF 1 Simany near existing production. Pay was a 59-ft. Lower Tertiary sandstone at 3,410 ft. which tested 33° oil at the rate of 25 bbl. per hour. SPAEF and Mobil International 1 Pointe Weze was a rank wildcat 3½ miles south of N'tombenyoni which flowed 20 bbl. in 40 minutes on test at a depth of 3,962 ft.

Distress conditions cited by AAODC exec

DISTRESS CONDITIONS are becoming increasingly serious for U. S. oil and gas-drilling contractors. This is the gist of the statement made by Warren L. Baker, executive vice president of AAODC, before the U. S. House of Representatives Select Committee on Small Business during hearings held recently in Washington, D. C., concerning the Mandatory Oil Imports Control Program.

Baker cited the fact that between 1956 and 1960 there has been a 19.6% reduction in U. S. drilling activity by contractors. This is a decline of 26.9% in rigs able to find work and a loss of 4.5% in prices despite the additional expense of drilling the wells 5% deeper.

These foregoing conditions have created such an acute economic crisis that today there are 25.7% fewer rotary drilling contractors, 14.5% less rotary rigs available for work, and a reduction of 25.7% in the number of crew men employed by rotary-drilling contractors.

According to Baker, rising imports have been a major factor in creating these very undesirable and unhealthy conditions, because oil imports have exerted a depressing influence on domestic crude-oil prices. Despite voluntary and mandatory import restrictions, imports have risen 26.5% during the period of 1956-1960, an increase of 140 million barrels. The net effect is a drop in domestic production of 42 million barrels and a price drop of 17 cents per barrel during the 5-year period.

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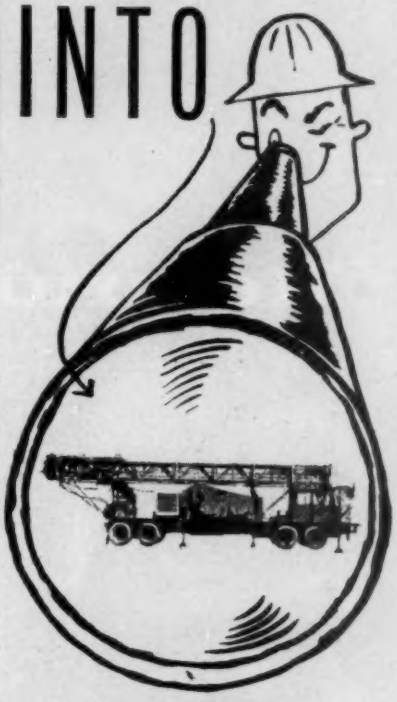
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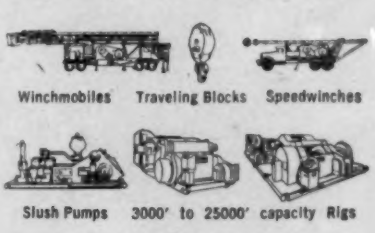
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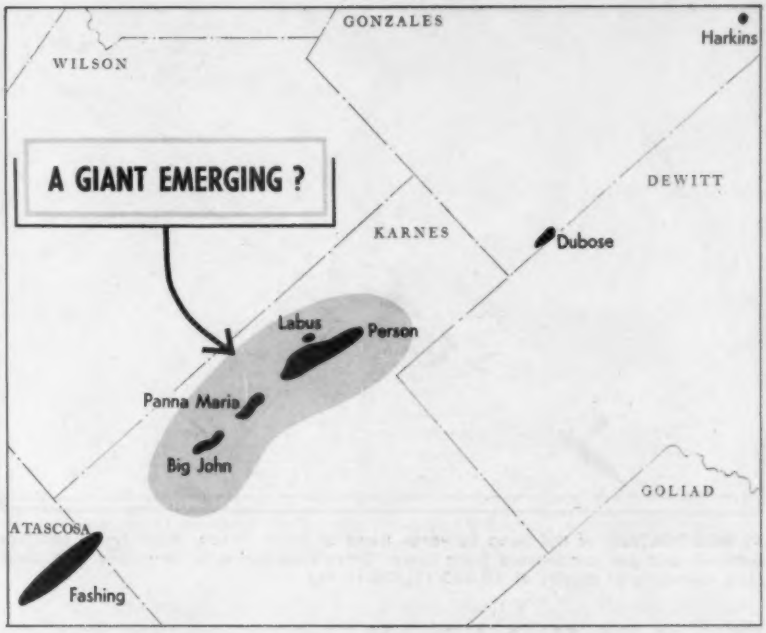
Exploration

Giant fields from littler fields do grow

BY FRANK J. GARDNER



WILL THESE THREE FIELDS become one? Some observers believe they will. If and when this happens, South Texas may have its first giant field in several years.

OIL-RICH TEXAS just might have another giant on its hands. If so, it would be the second one to emerge this year, the first having been East Texas' Fairway field (OGJ, Sept. 11, 1961, p. 75).

It's still too early to tell just what's going to happen down in Karnes County, but on the next three pages, you can read about what's happened so far. It's what author Raymond Knapp leaves unsaid that's intriguing.

For Person field, the subject of Knapp's article, lies on direct trend with two other oil fields immediately to the southwest. These are Panna Maria, 2½ miles away, and Big John, 7½ miles away (see map). At this point, there's no indication that the three fields are separate accumulations, and a field 15 to 20 miles long is easily envisioned should they be linked.

Three fields in one. And there are those who think they will be. At a Railroad Commission hearing last August, field rules for Panna Maria were debated, and in its November 1 Special Order on the field, the commission stated that ". . . continued development along the subject Edwards trend may cause the three aforementioned fields to be joined together."

Person was the first oil field to be found along South Texas' now-famous "Deep Edwards Trend." An earlier chain of gas fields had been uncovered in reef of Edwards-Lower Cretaceous age, but these were southwest and downdip from Person, which is a fault trap. Discovered in August 1959, the field now has 54 oil wells, producing 10,382 bbl. daily. Panna Maria was opened in September 1960, and has 12 wells producing 2,111 bbl. Big John, found in November 1960, now has seven wells producing 780 bbl. per day.

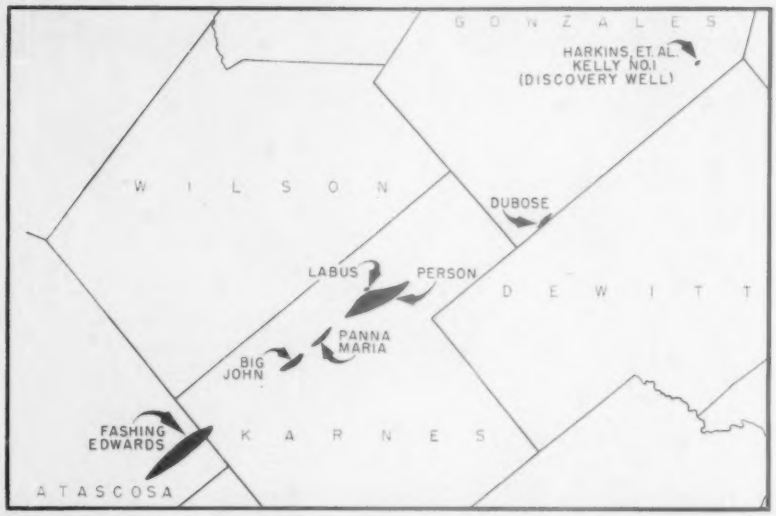
Producing depths of the three fields are almost identical, ranging from 10,500 to 10,700 ft. subsea. Reservoir characteristics are comparable, and there are no Edwards failures separating the three. Therefore, the possibilities of a merger are good to excellent. Structural quirks that may be uncovered in future drilling could, of course, change all this—and the chances of such quirks are good, as in all faulted areas.

How far could this thing go? Fashing, a giant gas field about 10 miles southwest of Big John (see map), has two oil wells in the Edwards at 10,400 ft. subsea, and there's been very little exploring between the two fields. A key wildcat now is drilling halfway between the two; this is Viking Drilling Co. et al. 1 Tom Clark, and it looks like a gas strike at the moment. Edwards perforations at 11,076-11,-107 ft. flowed gas (no gage), and at last report the well was waiting on potential test.

Means a new giant. At this time, it would be imprudent to predict a linkup of Fashing with the Big John-Panna Maria-Person complex, but certainly a meshing of the last-named fields is not out of reason. If and when this happens, Texas will have its new giant, and South Texas may begin to realize the true potential of its deeply buried Edwards reservoirs.

It's seldom we print a study of a single field these days, for readership surveys have revealed a high preference for regional articles. But in this case, we feel it's justified, if the Person field study which appears on the next three pages can stimulate the search for similar fields in other parts of South Texas.

There are those who say that South Texans have found most of the oil to be had above 8,000 ft. in their bailiwick. You may or may not agree. But certainly the existence of such fields as Big John, Panna Maria, and Person demonstrates that there's a lot to look forward to in rocks below 10,000 ft.



IN THIS PORTION of the Deep Edwards trend of South Texas, these fields produce both oil and gas condensate from Lower Cretaceous-Edwards limestone and dolomite members at depths of 10,000-12,500 ft. Fig. 1.

Person field indicates tremendous potential of deep Edwards trend

BY R. W. KNAPP
Production Geologist,
Shell Oil Co., Corpus Christi, Tex.

THE RECENT Edwards play in eastern Atascosa, Karnes, and Gonzales counties of South Texas has resulted in the discovery of seven new fields in a little over 5 years, with the promise of more to come.

These fields produce both oil and gas condensate from porous Edwards (Lower Cretaceous) limestone and dolomite members entrapped at depths of 10,000 to 12,500 ft. by individual faults along a northeast-trending regional fault system.

The first discovery along this trend was Fashing gas field in July 1956, and the second discovery and largest oil accumulation among the fields is Person, discovered in August 1959 approximately 10 miles northeast of Karnes City, Tex.

Later field discoveries on the trend are Big John, Panna Maria, DuBose, Labus, and an apparent field discovery, Harkins et al. 1 Kelly in southeastern Gonzales County. The locations of this series of fields are shown in Fig. 1.

Before the discovery of Fashing field, the only Edwards production of comparable depth in South Texas was obtained in gas fields along the Edwards reef trend stretching in a northeastward direction across La Salle and McMullen counties. The new fields are not a part of this reef trend but are associated with carbonates of a restricted shallow marine platform facies occurring updip from the reef facies.

The discovery of Person was made by Brazos Oil & Gas Co. in its 1 Otha D. Person, drilled on a seismic anomaly along the regional fault system. It found the top of the Edwards at 10,799 ft. and was completed in August 1959, as an Edwards oil well through perforations 10,886-10,900 ft. for a potential of 650 bbl. of oil per day, through a 17/64-in. choke. Confirmation wells were drilled in quick succession by Brazos and Shell Oil Co. Later development was undertaken by these two companies, by Standard Oil Co. of Texas, and by several firms with smaller holdings in this vicinity. Fifty-four Edwards wells have now been completed and development is still in progress.

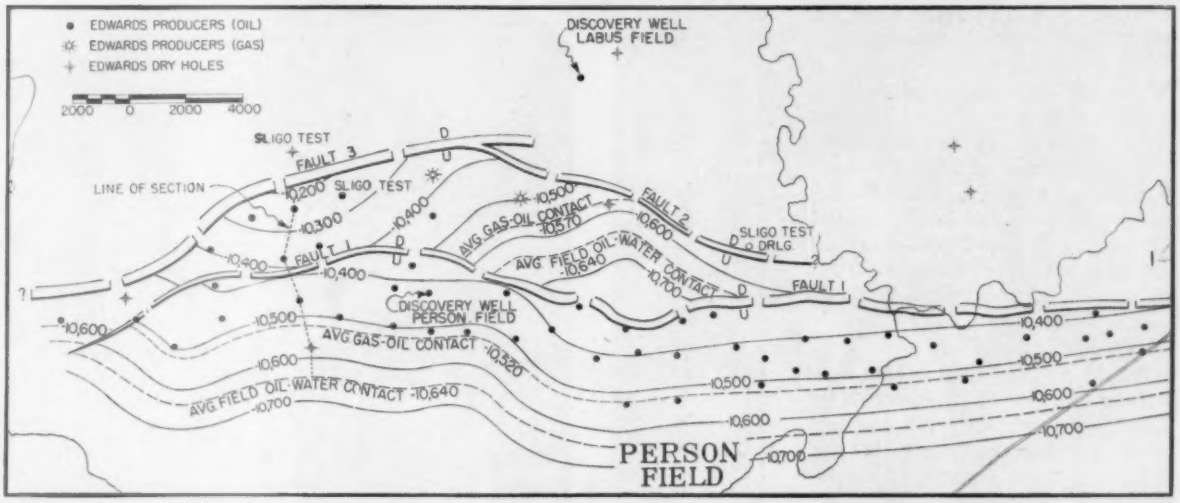
Faulted reservoirs. The accumulation at Person, Figs. 2 and 3, is controlled by three major, slightly arcuate "up-to-the-coast" normal faults, forming traps in the south-to-southeastward-dipping monoclinal Edwards formation. The field limits, currently 7½ miles long and slightly over a mile wide, have been essentially defined, with some segments to the northeast and southwest remaining inadequately evaluated.

The Edwards reservoir in Person field has been divided into two zones for identification purposes, Figs. 3 and 4. The "upper" Edwards averages 175 ft. in thickness, of which the top 90 to 100 ft. is predominately limestone with some streaks of dolomite, and the lower 70 to 80 ft. is mostly dolomite. The major portion of the oil production is being obtained from the dolomite porosity. The "lower" Edwards averages 375 ft. in thickness and is predominately limestone, separated from the "upper" Edwards by a dense limestone zone. Porous streaks in the upper Edwards average approximately 15% porosity but are of a low order of permeability, about 3 md. The porosity of the

About the author

R. W. Knapp holds a BS degree in geology from Rensselaer Polytechnic Institute. He joined Shell Oil Co. in 1957 as a junior exploitation engineer in Billings, Mont. After completing training assignments in Montana and Texas, in 1958 he was named exploitation engineer at Shell Development Co.'s E&P research division in Houston.

In January 1959, he was moved to Shell Oil's Kilgore office as an exploitation engineer. Later that same year, he returned to Houston in the same capacity. He was named production geologist in the Corpus Christi division, his present assignment, in June of this year.



STRUCTURE CONTOURS of Person field reveal the three up-to-the-coast faults that control production. Both the gas-oil and oil-water contacts of the Edwards section are shown. Fig. 2.

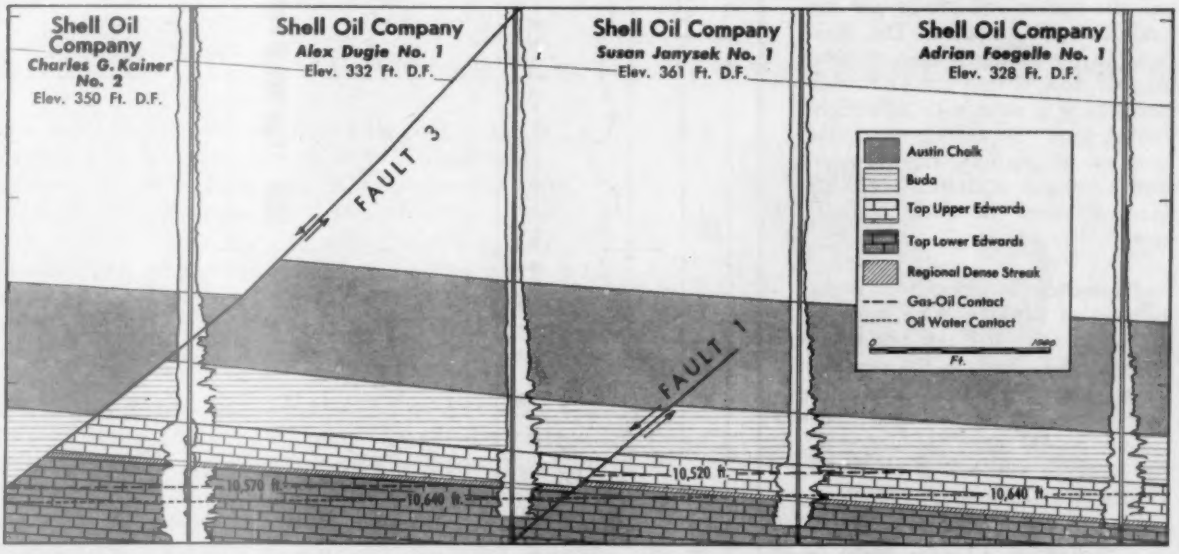
lower Edwards averages 11% and the permeability is approximately 0.5 md.

An average oil-water contact at 10,640 ft. subsea is apparently common to the entire field, while the segments of the field separated by Fault 1 have different gas-oil contacts. An oil column of approximately 120 ft. is present south of Fault 1 below an average gas-oil contact at 10,520 ft. subsea. North of Fault 1, the average gas-oil contact is 10,570 ft. subsea, giving an average 70-ft. oil column. Original reservoir pressure and temperature were 5,180 psig. and 283° F. at 10,600-ft. subsea datum.

As of September 1, 1961, 46 wells have been completed in the upper Edwards (including two shut-in gas wells) and 8 oil wells have been completed in the lower Edwards. Total cumulative production as of August 1, 1961, is 962 000 bbl. of oil, of which 837,000 have been produced from the upper Edwards and 125,000 from the lower Edwards. The driving mechanism is not known at the present time, but limited pressure data indicates that the primary recovery efficiency may be quite low.

Objectives above the Edwards have been indicated water-bearing in drilling at Person. Two deep tests, Shell 1 C. G. Kainer and Shell 1 John Jaskinia along the northwestern perimeter of the field, have tested the Lower Cretaceous formations below the Edwards down to the Sligo with disappointing results. Both wells had porosity in the Sligo between 13,470 and 13,600 ft. which yielded gas but proved to have such low permeability that a commercial completion could not be made. A third Sligo test, Brazos et al. 2 Yanta, is now drilling just northwest of the center of the field.

Through the completion of many wells in Person field, a standardized drilling and completion technique has evolved. The average Person



THIS NORTH-SOUTH cross-section (left to right) shows how different portions of the Edwards section produce and helps explain the dry hole to the right. See Fig. 2 (above) for line of section. Fig. 3.

field well now costs about $140,000 to drill and complete as follows:

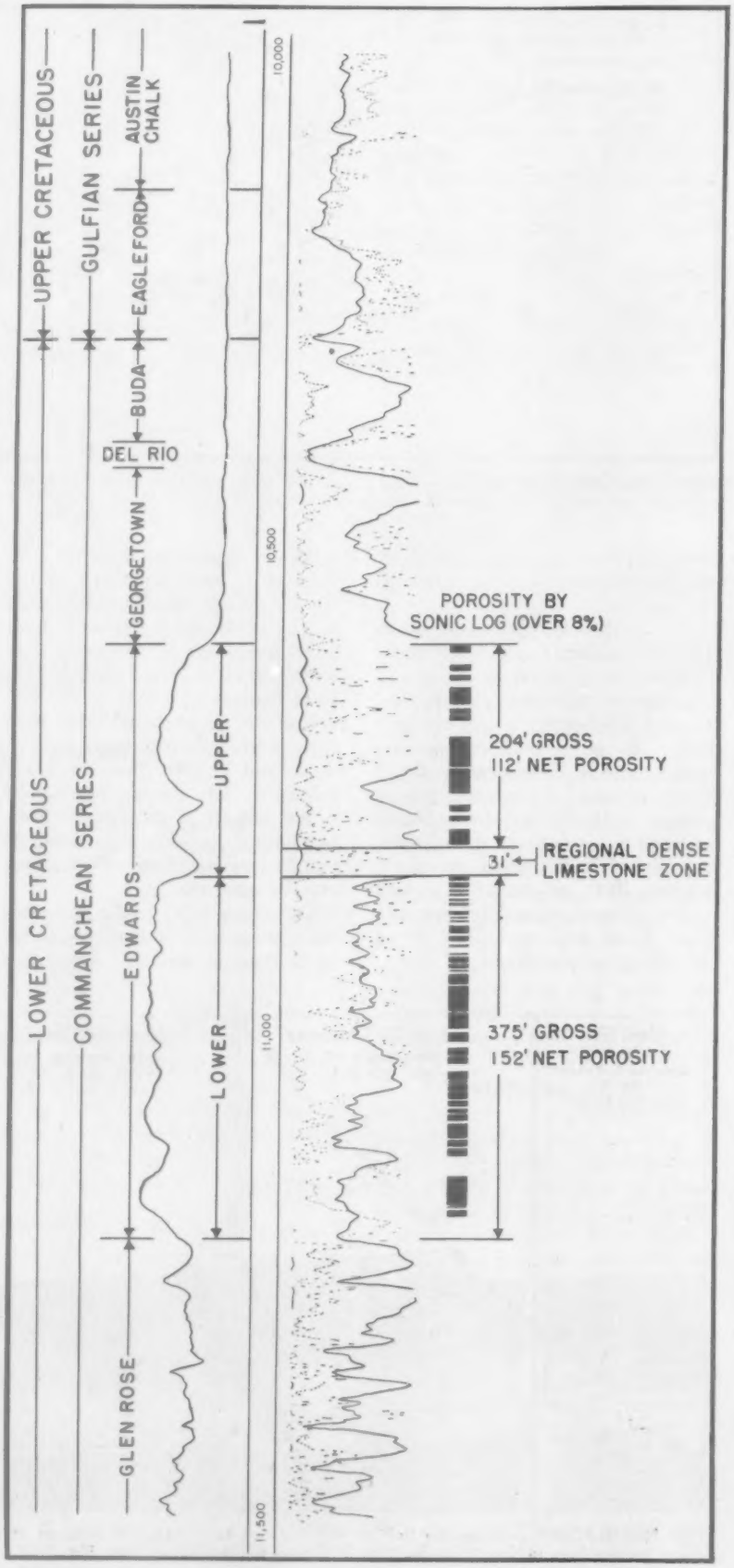
Casing. The 9⅝-in. surface string is cemented at 1,800 ft., and an 8¾-in hole drilled to total depth; 5½-in. casing is cemented through the pay. Generally, while drilling in the northern part of the field, a DV tool is included to cement off the fresh-water Carrizo-Wilcox sands which occur between 3,000 and 4,300 ft.

Mud. A water-base drilling mud is used to 7,000 ft., then converted to a low-lime, oil-emulsion mud which increases the drilling rate and maintains better hole conditions. A maximum mud weight of 11 lb. per gal. is sufficient since no high pressure formations are encountered.

Logging. A combination of an induction-electrical log and a Sonic, or short-interval velocity, survey with a caliper has evolved as the best logging program effective in delineating the various porous zones throughout the Edwards formation and evaluating the productive possibilities of these porous intervals. Fairly reliable porosities are obtained from the sonic log and the caliper indicates some order of the permeability by the mud-cake development.

Completions. A modification of the permanent-type completion technique is used. After displacing the mud in the casing with inhibited oil, the packer and tubing are run and the tree installed. The fluid head in the tubing is then reduced so that flow is into the well when perforating is done with a through-tubing gun. Depending upon the amount of porosity development, 500-2,500-gal. acid treatments are generally used for initial stimulation.

Production facilities. Automatic production facilities have been installed to serve a major portion of Person field. Early in the development history of the field, permission was granted by the Railroad Commission to: (1) meter production off the lease on which it is produced, (2) commingle multiple-royalty-in-



A TYPICAL columnar section at Person shows the porosity zones of the Edwards reservoir. Fig. 4.

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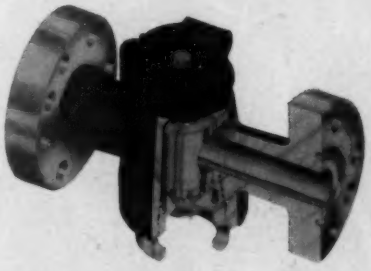

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terests oils into a common battery and allocate production on the basis of meter readings (3) install ACT systems to transfer oil automatically to the purchaser from a common tank battery, and (4) install a common test vessel to serve more than one lease. To date, Shell is the only operator to install ACT units for automatic sales into Magnolia Pipe Line Co.'s recently constructed oil-gathering system.

The hydrocarbons in the Edwards reservoir at Person have a high sulfur content. Shell is currently making plans to build and operate a 15-million-cubic-foot-capacity gas-treating plant at Person which will be owned by all of the operators in the field on a joint-venture basis.

A closeup view of Ohio's fast-moving Trempealeau Cambrian oil play in Canaan Township, Morrow County. Two new producers were added recently. United Producing Co. 3 O&E Myers, Section 33, was bottomed in granite at 4,100 ft. Production was found at 2,980-96 ft. The well made 20 bbl. per day. Atlas Exploration Co. 1 Wolfinger in Cardington Township, 1¾ miles southeast, is pumping 100 bbl. per day and 40 bbl. water. This Section 3 well found Trempealeau oil at 2,995-3,025 ft. Production is coming from the eroded top of the Cambro-Ordovician. United Producing Corp., a subsidiary of United Carbon Co., holds all acreage except that outlined on the map.

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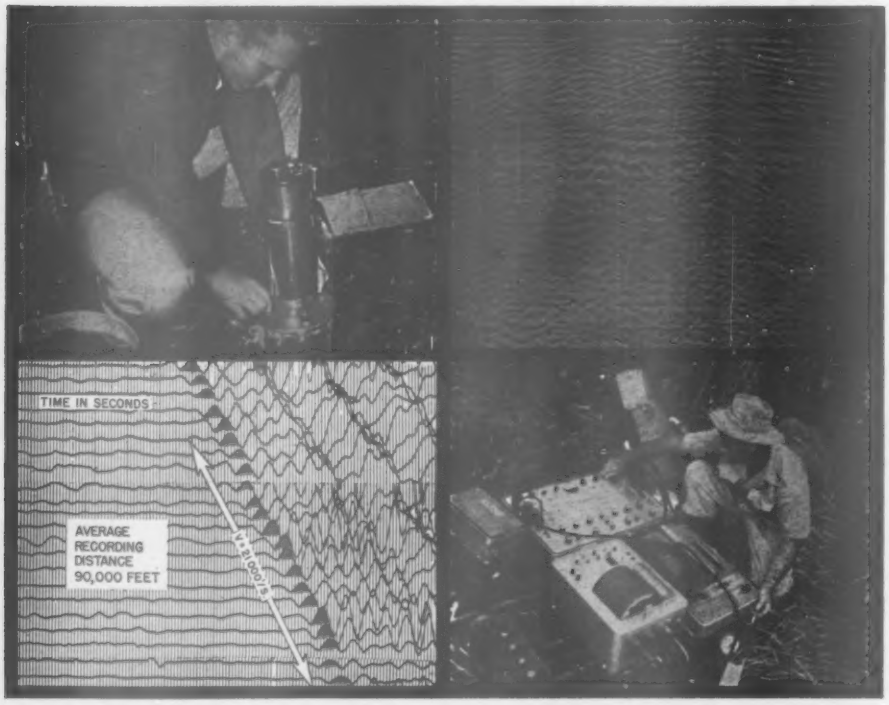

this 12-page brochure briefly describes GSI's facilities for:

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Leasing hints Michigan play

INTEREST evidenced at the November auction of leases on state-owned lands gave additional support to the predictions of a brisk exploratory play in northern Michigan counties in 1962.

The Lands Department had takers on every tract offered in Alpena County, a total of 15,236 acres; and got action on Roscommon County and other scattered offerings.

Panhandle Eastern Pipe Line Co., Michigan Consolidated Gas Co., Texaco, C. K. Dean, Sun Oil Co. and Augie Busk were the chief buyers in Alpena County. Only a few scattered tracts went for the $1 (tract) minimum. Prices reached $2 and $3 an acre.

Preliminary plans for drilling programs involving as many as 50 wells across the northern end of the Lower Peninsula have been reported for 1962. The Niagaran will be the primary objective but several tests are sure to be carried to the Trenton.

The November state sale brought an average bonus price of $1 an acre for 26,477 acres.

Two Muddy wells finaled in Wyoming

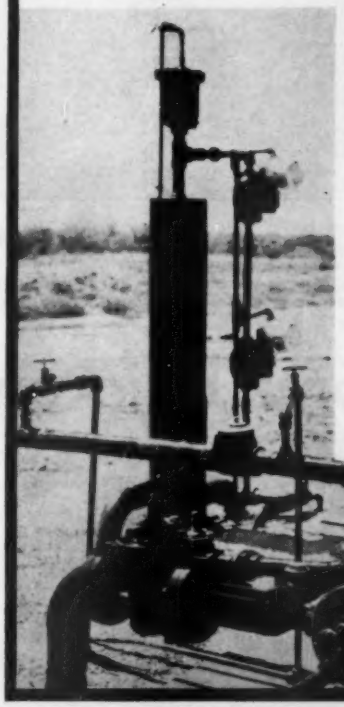
Two Muddy Cretaceous producers were completed in Wyoming's Powder River basin. Clark Oil & Refining Co. F-51-70-33-B4, SE SW 33-51n-70w, Ward Creek field, Campbell County, pumped 20 bbl. per day from perforations at 7,183-88 ft. The southwest offset well, F-50-70-4-B2, C SE NW 4-50n-70w, Campbell County, pumped 76 bbl. per day from perforations at 7,350-56 ft. The discovery well here was F-50-70-O-C1, SW NE 4-50n-70w. That strike made 30 bbl. per day from perforations at 7,251-58 ft. This new field lies northwest of Rozet field about 2½ miles, separated by failures.

Crook County. Shell Oil Co. and Davis Oil Co. completed a new Minnelusa Pennsylvanian discovery at 1 Federal-Robinson in SW SE 22-50n-67w, Crook County.

The well, 2 miles east of the north side of Robinson Ranch field, pumped 503 bbl. per day. Production is from perforations at 5,650-56 and 5,666-72 ft. Robinson Ranch is also a Minnelusa producer.

Shell Oil Co. 34-2 Schuricht, SW SE 2-52n-68w, Crook County, pumped 696 bbl. per day from Minnelusa perforations at 6,688-98 ft., extending the recent find at Davis 1 Schuricht, SW NE 11-52n-68w. That well made 377 bbl. in 16 hours on pump on completion. The south offset try was dry. There are locations in the new field by both Shell and Mobil.

Ask Pump "Pros" who compare costs in pennies per gallon pumped They'll say, "Specify Viking Pumps"



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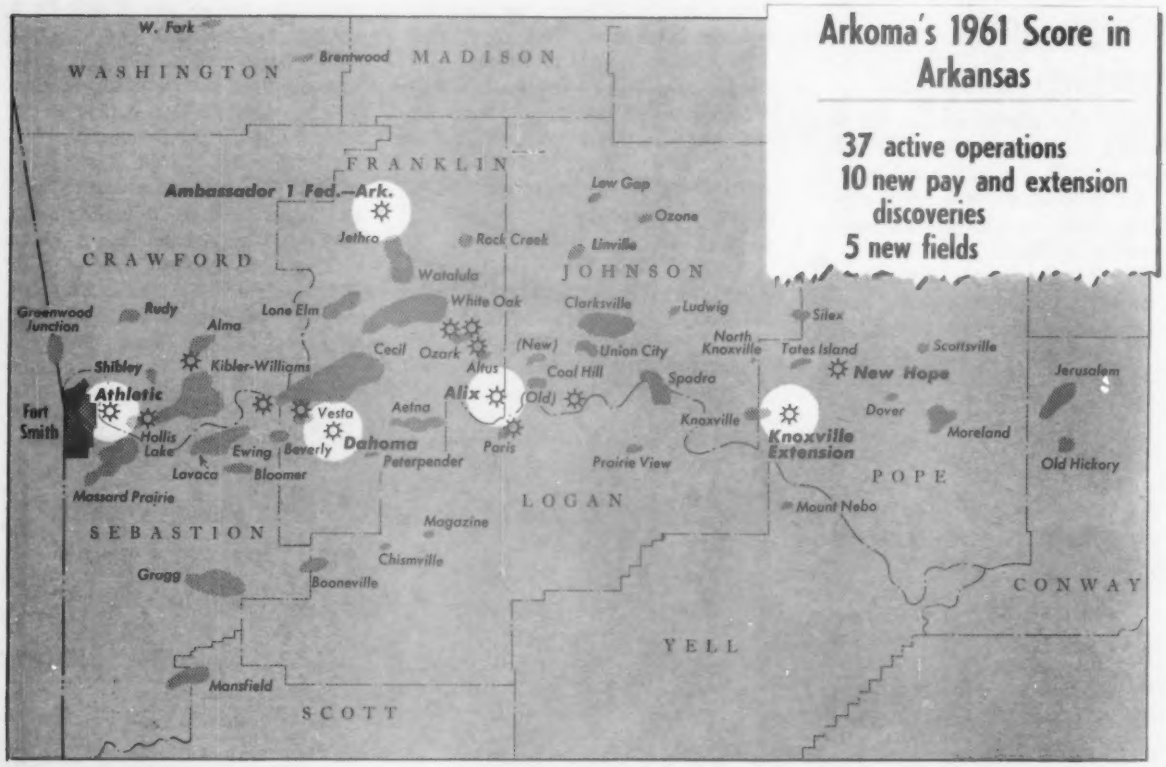


ARKANSAS' PORTION of the two-state Arkoma basin extending eastward from the Oklahoma line through at least 10 Arkansas River Valley counties now boasts an impressive list of gas fields. White circles indicate 1961's additions, including an indicated new-field discovery by Ambassador Oil Corp. in northern Franklin County. Not so indicated is this year's New Hope field discovery (shown only by gas-well symbol) in Pope County. Other indicated gas wells are this year's new-pay and important extension discoveries. Omitted from the map is the one-well Quitman field, in Cleburne County, 30 miles east.

Arkansas' Arkoma quickens pace

NORTHWEST Arkansas' side of the two-state Arkoma basin is feeling a stepup in drilling that is putting this year well out in front of 1960 not only in new gas discoveries but also in total number of wells drilling.

This is a reversal of the general outlook during the greater part of the year in which drilling, discoveries, and well completions have lagged behind those of the previous year.

Latest count lists more than 35 active drilling operations in the basin. There has been a steady increase in activity in recent weeks, placing this number at the highest level it has been all year.

Coincident with the pickup in drilling activity, the increase in wells completed has boosted the total for the year above the 60 mark. With more than a month remaining in the year, the number of wells already completed was well ahead of the total for all of 1960.

Completions listed late in November actually totaled 63 wells as compared with 1960's total of 48. This is an increase so far of 15 wells.

Among the more than 35 active operations there are at least 4 wells that are testing and in process of completion to raise the total. In addition, many of the others are nearing objective depths and should be completed by year-end. Replacing these is a steady run of new locations and additional wells being started that for the time being is keeping up the number of active drilling operations.

Total completions so far this year include 40 gas wells and 23 dry holes. These compare with 33 gas wells and 15 dry holes completed

Arkansas' Arkoma basin new-field 1961 discoveries

Field	County	Discovery well	Month comp.	Total depth (ft.)	Prod. depth (ft.)	
New Hope	Pope	Gulf Oil Corp. 1 Jones	Jan.	5,285	3,063-76	Atoka-Casey Sd.
East Knoxville*	Pope	Stephens, Inc. 1 Bewley	May	6,580	3,036-45	Atoka-Tackett Sd.
Unnamed	Sebastian	Athletic-Stephens 1 Wilson	June	6,044	5,880-5,936	Morrow-Hale Sd.
					2,009-23½	Atoka-Upper Alma
Dahoma†	Franklin	Republic Nat. Gas 1 McGee	Nov.	6,943	6,554-92	Morrow-Lower Hale
Alix	Franklin	Humble O & R Co. 1 Hembree Unit	Nov.	7,000	5,178-86	Atoka

*Three-mile east extension of Knoxville field. †Possible 3-mile extension of Peterpender field.

Arkansas' Arkoma basin gas fields

Field	County	Discovery year	Producing formations: Atoka series depth range (ft.)	Producing formations: Morrow series depth range (ft.)	No. producing wells
Mansfield	Sebastian-Scott	1902	860-2,050	.....	13
Massard Prairie	Sebastian	1904	1,300-5,000	5,400-5,500	61
Kibler	Crawford	1915	1,600-5,000	5,150-5,200	48
Alma	Crawford	1916	2,500-2,700	.....	7
Williams[1]	Crawford	1918	.....	.....	..
Section 10	Crawford	1920	2,500	.....	4
Clarksville	Johnson	1921	2,300-4,300	.....	15
Shibley	Crawford	1926	1,200-2,275	.....	6
Greenwood Junction	Crawford	1927	800-1,200	.....	4
Lavaca	Sebastian	1928	3,000	.....	2
Aetna[2]	Franklin	1928	1,750-5,500	5,300-5,700	5
Tates Island	Pope	1929	1,050-1,300	.....	3
Coal Hill[3]	Johnson	1929	1,980-3,600	.....	5
Ozark	Franklin	1930	1,800-3,750	3,830-4,200	13
Vesta	Franklin	1932	2,000-3,120	.....	11
Ewing	Sebastian	1936	2,500-2,600	.....	4
Beverly	Sebastian-Franklin	1937	1,800-2,000	.....	5
Silex	Pope-Johnson	1942	2,600-2,800	.....	2
White Oak	Franklin	1943	1,350-3,300	4,000-4,120	26
Bloomer	Sebastian	1945	2,700-6,000	.....	2
Cecil	Franklin-Sebastian	1949	1,300-4,760	4,500-5,440	39
Rudy	Crawford	1949	1,490-1,870	2,050-2,200	5
Lone Elm	Franklin	1950	2,260-3,820	3,880-3,890	7
Low Gap	Johnson	1951	1,150-1,327	.....	1
Massard Deep[6]	Sebastian	1951	.....	.....	..
Ozone	Johnson	1952	.....	2,352-92	1
Linville	Johnson	1952	1,180-1,560	.....	2
West Fork*	Washington	1953	.....	.....	2
Watalula	Franklin	1953	2,680-3,780	.....	3
Prairie View	Logan	1954	1,370-1,400	.....	1
Spadra	Johnson-Logan	1954	3,490-5,000	5,570-6,280	6
Moreland	Pope	1954	3,900-4,150	4,460-4,520	6
Jethro	Franklin	1955	1,750-1,800	2,170-2,200	5
Gragg	Sebastian	1955	1,550-5,960	.....	15
Aetna[2]	Franklin	1955	.....	.....	..
Jerusalem	Conway	1956	1,940-2,100	.....	6
Hollis Lake	Crawford	1958	1,700-5,340	5,510-5,620	5
Paris	Logan	1958	.....	6,900-7,000	2
Boonville	Logan-Sebastian	1958	1,580-4,900	.....	4
Coal Hill[3]	Johnson	1958	.....	.....	..
Union City	Johnson	1958	4,380-5,200	.....	3
Knoxville	Johnson-Pope	1958	3,030-3,570	.....	9
Old Hickory	Conway	1958	2,668-91	.....	1
Brentwood*	Washington	1959	.....	.....	2
Rock Creek (Barnes)	Franklin	1959	1,240-2,025	.....	6
Peterpender (West Aetna)	Franklin	1959	.....	7,600-32	1
Chismville	Logan	1959	1,130-2,700	.....	2
Magazine	Logan	1959	5,818-23	.....	1
Dover	Pope	1959	3,380-3,850	3,990-4,015	3
North Knoxville	Pope	1959	4,531-38	.....	1
Quitman	Cleburne	1959	1,956-98	.....	1
Delaware (Mount Nebo)	Yell	1959	3,880-4,065	.....	2
Altus	Franklin	1960	4,875-5,000	5,035-5,400	3
Scranton	Logan	1960	3,000-6,770	7,015-7,375	4
Ludwig	Johnson	1960	3,536-60	.....	1
Scottsville	Pope	1960	1,739-48	1,936-47	1
New Hope	Pope	1961	3,063-76	.....	1
Unnamed[4]	Sebastian	1961	2,009-23½	5,880-5,936	1
Dahoma[5]	Franklin	1961	.....	6,554-92	1
Alix	Franklin	1961	5,178-86	.....	1
Knoxville Extension	Pope	1961	3,036-45	.....	1

*West Fork productive from Mississippian-Sylamore at 565 to 630 ft.; Brentwood productive from Mississippian-Wedington at 565 to 1,450 ft. (1) Combined with Kibler. (2) Abandoned in 1950 with two shallow wells; reopened in 1955. (3) Original one-well Coal Hill field abandoned; reopened in 1958. (4) Athletic Mining & Smelting Co.—Stephens Prod. Co. 1 Stephens. (5) Possible long extension Peterpender field. (6) Combined with Massard Prairie.

the previous year. With these figures the success ratio for this year has been slightly under that of 1960, being a decline from nearly 69% to about 63½%.

Among the gas wells completed are five that open new fields for the basin, or at least, in two cases, major extensions that greatly enhance the importance of existing fields.

The three entirely new fields (see table and map) found include New Hope, in Pope County; an unnamed area at the east edge of Fort Smith, in Sebastian County; and one not yet officially opened just southeast of Alix, in Franklin County.

Each of these is from 5 to 6 miles from any other field and represent separate producing areas. Discovery well of the so-far-unnamed area in Sebastian County was drilled by Athletic Mining & Smelting Co. in conjunction with Stephens Production Co., and is completed in two zones of different formations—the Atoka-Alma sand, and the Morrow-Hale sand.

The recent Dahoma discovery in Franklin County is 2½ to 3 miles northwest of Peterpender (West

Arkoma basin new pays and extensions

Field	County	Discovery well	Month comp.	Total depth (ft.)	Prod. depth (ft.)	
Artus	Franklin	J. M. Huber Corp. 1 Kramer	July	5,447	4,976-5,002	Atoka-Kelly Sd.*
					5,392-5,402	Morrow-Hale
Cecil	Sebastian	Stephens, Inc. 1 Williams	Aug.	5,610	1,307-20	Atoka-Williams Sd.*
					5,402-40	Morrow-Hale Sd.
Hollis Lake	Crawford	J. M. Huber Corp. 1 Lincoln	Mar.	5,727	4,554-88	Atoka-Dunn "B"*
					5,510-5,616	Morrow-Hale Sd.
					5,054-84	Atoka-Spiro Sd.
Kibler	Crawford	Ambassador Oil Corp. 1 Kreuger†	June	5,918	4,978-88	Atoka-Ralph Barton*
Ozark	Franklin	Mull Drilling Co. 2 Mayner	Mar.	4,157	4,062-68	Morrow-Brentwood*
					3,154-84	Atoka-Cecil Dunn "A"
		Mull Drilling Co. 1 Doyel	June	4,284	2,912-69	Atoka-Hanson Sd.*
					3,235-50	Atoka-Dunn "A"
					4,078-4,192	Morrow-Brentwood
Paris	Logan	J. M. Huber Corp. 1 Smith†	July	7,337	6,918-40	Morrow*
Scranton	Johnson	Gulf Oil Corp. 1 McAlester†	Aug.	6,952	3,006	Atoka-Lower Carpenter*
					4,472	Atoka-Areci*
Vesta	Franklin	Gulf Oil Corp. 1 Drake†	Sept.	6,850	3,060-3,121	Atoka-Morris*

*New pay. †Extension well.

Aetna) field, opened in 1959. It is considered by some a long extension of that field, in which the discovery well so far is the only production. Both wells produce from the Morrow-Hale sand.

The East Knoxville discovery on the table also is rated as a long extension of Knoxville field, but is 3 miles east of that field's nearest well. As an extension it places that field among the basin's larger producing areas in aerial extent. Knoxville was opened in 1958 and now has nine productive wells stretched out along the Pope and Johnson County line.

Considering all five discoveries as opening new fields, they pass in number 1960's list of four new-field discoveries. They still lack four field discoveries of equalling 1959's record of nine new fields found. The next-highest number of new fields found in any one year was in 1958 with six discoveries.

Of the currently active drilling operations, 11 are in out-and-out wildcat areas with favorable prospects. They offer possibilities of finding production and further increasing this year's list of discoveries. One already has had indications of gas production while testing showings in the Washington member of Mississippian age.

This wildcat drilled by Ambassador Oil Corp. in northern Franklin County flowed at the rate of 150 M.c.f.d. of gas in open-hole tests while drilling the Wedington, topped at 2,312 ft. Since then, with hole drilled to 2,610 ft., casing has been run to 2,452 ft. and perforated at 2,348-58 ft. for completion. Testing now is under way with flow rates as high as 278 M.c.f.d. being reported.

Location is more than 3½ miles northwest of Watalula field, a 1953 discovery productive from Pennsylvanian Atoka sands. It is at the far-north reaches of Pennsylvanian exploration and development of the basin. So far, the Mississippian has been found commercially productive only in two fields. Both of them, West Fork and Brentwood, are in Washington County, farther north on the rim of the basin where Mississippian sands are at relatively shallow depths.

In addition to the five new fields found so far this year, new pay zones have been opened or important extensions made in at least eight previously discovered fields. In one, two different wells added separate new pays. Six of the wells making these discoveries were as multiple zone wells with production not only from the new pays but also from one or more of their respective fields' other pays.

With this year's discoveries, Arkansas' portion of the basin now has 58 known fields, spread through 10 counties along the Arkansas River Valley. Their record, dating from first gas production in the old Mansfield field, discovered in 1902, is listed in an accompanying tabulation. One far-removed gas well, designed as Quitman field, in Cleburne County, 30 miles east of the next most easterly field of the basin, has been omitted from the map.

Of the 58 fields, 24 have been found within the last 4 years, a period in which major interest has been revived in Arkoma basin's potentialities as an important gas-producing region.

Although many fields have had only limited development, due both to limited market outlets for the gas during much of the time and to difficult and costly drilling conditions, 390 gas wells have been completed to date.

With the exception of the two Mississippian fields on the north edge of the province, all production—so far exclusively gas—has been from Pennsylvanian Atoka and Morrow sands ranging in depths from near surface in some places to slightly below 7,000 ft. As many as 13 to 15 separate zones have been identified as producing in the Atoka sections. Production from the Morrow is from at least main zones, including the Kessler, Woolsey, Brentwood, Cannon, and Hale sands. Relatively few wells have been drilled below these horizons although deeper formations hold potentialities for exploration and development of additional production.

SW Kansas shows pre-Permian interest

Pre-Permian exploration stepped up in Kansas' southwestern counties with extensions and new pools reported in several areas.

Clark County. Graham-Michaelis Drilling Co. extended Harper Ranch field 1 mile east at 1-26 Carthrae, C NW SE 26-33s-21w.

The well flowed 8 M.M.c.f.d. from Morrow Pennsylvanian sand at 5,378-85 ft.

A Krider Permian gas discovery is reported in Scott County, ⅜ mile west of Shallow Water.

Republic Natural Gas Co. 1 Smith "A," C SW NW 25-19s-33w, an old dry hole reworked, flowed 7,536 M.c.f.d. from perforations at 2,655-70 ft.

Comanche County. Continental Oil Co. opened new Mississippian gas production at 1 Biddle in C NE NE 13-33s-17w, 10 miles southeast of Coldwater.

The well flowed 2,500 M.c.f.d. from perforations at 5,034-46 ft.

Hamilton Brothers, Inc., have a dual Keyes and Morrow sand gas discovery in Morton County at 1-2 Dean, NW SE SE 2-32s-42w, 3½ miles northwest of Richfield.

The well flowed 1,850 M.c.f.d. from Morrow "G" sand perforations at 4,974-94 ft. From Keyes the well flowed 2,200 M.c.f.d. at 5,051-54 ft.

Big gas well finaled near Arkansas line in Arkoma

Cedars field, LeFlore County, eastern Oklahoma, has a big new gasser at LeFlore County Gas & Electric Co. 1 McWaters, SE NW SW 4-9n-27e.

This well, located north of the field, had a calculated open flow rating of 24,500 M.c.f.d. based on a 4-point test.

Drilling spreads evenly over Oklahoma

OKLAHOMA exploration efforts continue to run smoothly. Developments are reported in all of the state's major drilling areas.

Sinclair Oil & Gas Co. 1 Westover is a new Oswego lime discovery in C NE SW 30-16n-16w, opening Southeast Putnam field.

The well flowed 190 bbl. of 43°-gravity oil in 12 hours through ½-in. choke from perforations at 9,752-74 ft. Pay is Oswego.

Sinclair has a good producer at West Valley Center field at the 1 Pryor in C SE NW 19-17n-17w. This well flowed 22,948 M.c.f.d. and 18 bbl. condensate per million on ¾-in. choke from Oswego perforations at 9,008-66 ft.

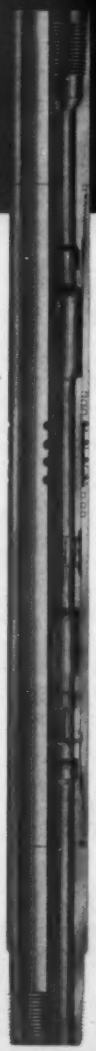
In Harper County, two fields have been linked by Pan American Petroleum Corp. The 1 Lockhart-C, C SW NE 14-26n-21w, links Lovedale and West Lovedale fields. The well flowed 24 M.c.f.d. from Tonkawa Pennsylvanian sand at 5,016-20 ft.

Arkoma basin. Events are happening thick and fast in southeastern Oklahoma's new gas province. Midwest Oil Corp. 1 McFerran, NW NE SW 2-6n-22e, is a possible extension of Red Oak gas pay in the Norris Deep field. Gas was found at 6,918 ft. while drilling.

Pure Oil Co. has reopened production in the old Spiro field in northern LeFlore County. The well flowed 467 M.c.f.d. during tests of perforations in the Spiro sand at 5,232-37 ft. at the 1 Foxwood unit in C NE SW 6-9n-25e.

Ambassador Oil Corp. has a Spiro sand gasser at 1 Kinnikin-Pate in SW NE SW 3-5n-18e, west of Wilburton in Latimer County. The well flowed 30 M.M.c.f.d. open flow from Spiro at 11,659-99 ft.

In Arkoma basin, Midwest Oil Corp. 1 Towry, N½ NE SW 11-6n-22e, east side of Norris Deep



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field, Latimer County, flowed 24 M.M.c.f.d. on a four-point test of Red Oak sand at 6,865-7,087 ft.

The same firm also added the second well to newly revived Rock Island field in LeFlore County. The 1 Smith unit, NW NW SE 11-8n-26e, flowed 443 M.c.f.d. from Atoka Pennsylvanian sand at 4,839-45 ft.

Kingfisher County. Jones & Pellow Oil Co. 1 Yeoman, C NE NW 24-18n-7w, North Dover field, flowed 384 bbl. of oil per day on 22/64-in. choke from Oswego perforations at 6,554-64 ft. From Manning Mississippian at 6,938-76 ft. the flow was 732 bbl. per day on 17/64-in. choke; from Meramec Mississippian at 7,192-7,200 ft. and open hole at 7,200-26 ft., flow was ½ bbl. hourly.

Humble Oil & Refining Co. has dual well at 2 Brooks in C NE NE 12-18n-7w, North Dover field. The well flowed 564 bbl. of oil per day on 20/64-in. choke from Manning at 6,854-82 ft.; 518 M.c.f.d. from Red Fork Pennsylvanian sand at 6,691-6,704 ft. on ½-in. choke.

Humble's 1 Pacula-Shimanek, C NE SE 34-20n-6w, East Hennessey field, flowed 264 bbl. in 7 hours on 20/64-in. choke from open hole at 6 661-6,705 ft. in Meramec. Testing continues in Manning at 6,440-68 ft.

Kay County. In northern Oklahoma, Pete Morris Drilling Co. 1 Lutz in C SE NW 14-29n-2w found production in Layton and Wilcox sands.

From Wilcox perforations at 3,741-45 and 3,764-68 ft. the well made 20 bbl. per hour on ½-in. choke; from Layton at 3,005-11 ft. it flowed 3 M.M.c.f.d.

Ohio completion stretches pool northeast

In Ohio's Washington Township, Hocking County, Lauck Drilling Co., Inc. stepped out more than a mile northeast of a recent good outpost well to prove additional acreage in Union Furnace pool. The reported initial production of this completion, 1 Pearl Bensonhaver, Section 16, was 100 bbl. of oil per day a month after fracture. The Clinton sand at 2,798 to 2,803 ft. had 12 bbl. natural.

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TUBING CASING HEADS

Ector County, Texas, field gains fifth producer

The fifth well in newly opened Cowden Cisco field in Ector County, 9 miles west of Odessa in West Texas, flowed 339 bbl. of 40.6°-gravity oil per day on 18/64-in. choke. It is Texaco Inc. 3 W. E. Cowden NCT-1 in Section 18, Block 43, T-2-S, T&P Survey.

The well flowed from perforations at 8,816-41 ft. Gas-oil ratio was 208:1, casing pressure 250 psi.

Texas' Leon opens new Woodbine field

A new Woodbine field, 15 miles from nearest other production from that horizon, has been opened in southern Leon County, East Texas.

Nearest other production is from the shallower Sub-Clarksville sand in Leona field, 3 miles northwest. The latter field was opened last April.

Both fields were discovered by R. H. Hedge and associates. Discovery well of the newer field, designated as OSR field, is their 1 Andrews, which flowed 191 bbl. of 38°-gravity oil per day through ¼-in. choke. Flowing pressure was 600 psi., and gas-oil ratio 994 cu. ft. per bbl.

Its Woodbine pay is perforated at 7,864-74 ft. Total depth of the hole is 7,931 ft.

Drilling already is under way on the second well, a quarter mile east.

Location is 5 miles southeast of Leona near the Madison County line.

Cotton Valley well completed in Texas

COMPLETION of its Cotton Valley discovery well in Opelika field of northern Henderson County, East Texas, is reported by Lone Star Producing Co.

The well, 1-B Allyn estate, is productive of dry gas from perforations at 10,653-11,658 ft. Top of the Cotton Valley was logged at 10,640 ft. from elevation of 447 ft.

Calculated open-flow potential of the well is 1,080 M.c.f.d. of gas. Shut-in pressure is 3,518 psi.

Hole was drilled to 14,503 ft. with bottom in Smackover lime, topped at 13,270 ft. Gas showings were tested in three zones in the latter formation but none proved commercial.

Cotton Valley is the fifth horizon to produce at Opelika. Others are Glen Rose, Rodessa, James, Pettet, and Travis Peak.

This is one of three East Texas fields added to the list of Jurassic producers this year. Others are Como, in Hopkins County, and Edgewood, in Van Zandt County. Como and Edgewood are productive from the Smackover member. Como's production also is a new-pay discovery.

With this year's discoveries, East Texas now has Jurassic production in 22 fields. Sixteen produce from the Smackover and six from the shallower Cotton Valley section.

Second Fairway strike taps Pettet pay

The second well in East Texas' large Fairway field to produce from the recently opened Pettet horizon extends production from that pay 4 miles southeast.

It is Fairway Operating Co.'s 1

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Vermillion unit, a mile southwest of Frankston, in Anderson County, which flowed at the rate of 297 bbl. of 53°-gravity oil per day through 18/64-in. choke from this new sand.

The well is dually completed in the Pettet sand and the field's main James lime formation. The latter zone produced at the rate of 395 bbl. of 48°-gravity oil per day through 13/64-in. choke.

The Pettet is perforated at 10,194-10,206 ft. and the James lime at 9,993-98 ft.

The Pettet discovery well, completed earlier this month by Atlantic Refining Co., is northwest of Frankston in Henderson County. It flowed 486 bbl. of 46.9°-gravity oil daily through 10/64-in. choke with pay perforated at 10,266-74 ft.

The Pettet is the fourth horizon to prove productive in the Fairway area. Pays include the original and main James lime, an Anhydrite stringer, the Rodessa, and the Pettet.

DISCOVERIES

Western Canada

Alberta:
United Producing et al. 14-5 West Fenn, LSD 14, 5-36-20w4. D2 oil discovery. TD 5,610 ft.
Panalta-Empire State 10-16 St. Wayne, LSD 10, 16-29-20w4. Basal Quartz gas discovery. TD 4,469 ft.
DeKalb 6-24 East Harmattan, LSD 6, 24-33-4w5. Elkton zone gas discovery. TD 8,661 ft.

Saskatchewan:
Quinalta-Albedena-Colorado 11-20 Herschell, LSD 11, 20-30-18w3. Viking oil discovery. TD 2,415 ft.

Kansas

Chase County:
Daetwiler Oil Co. 2 Koegebochn, 8 miles west of Elmdale in 8-19s-6e. IPP 20 BOPD, Viola open hole 1,962-71 ft. TD 1,971 ft. New oil discovery.

Chautauqua County:
August Oil Co., Inc., 1 Brown, NE NW NW 22-34s-8e, 1 mile southwest of Cedarvale. IPP 25 BOPD, Mississippian ope nhole 2,513-26 ft. TD 2,526 ft. New oil discovery.

Finney County:
Pan American Petroleum Corp. 1 Kisner Gas unit "C," C NW SE 36-26s-33w. 2¼ miles south of Beyer pool, 15 miles south of Garden City. IPP 7 BOPD, Morrow 4,995-97 ft. TD 5,500 ft. New oil discovery.

McPherson County:
George R. Hess 1 Ginder, SE SW NE 25-18s-1w. 4½ miles northeast of Canton. IPP 25 BOPD, Miss. open hole 2,795-2,802 ft. TD 2,802 ft. New oil discovery.

Morton County:
Hamilton Brothers, Inc., 1-2 Dean, NW SE SE 2-32s-42w, 3½ miles northwest of Richfield. IPF 1,850 M.c.f.d., Morrow "G" sand 4,974-94 ft., SICP 1,052 psi.; IPF 2,200 M.c.f.d., Keyes sand 5,051-54 ft., SITP 978 psi. TD 5,370 ft. Dual gas discovery.

Stafford County:
Dunne-Gardner Drilling Co. 1 R. Russell, NW SW NW 25-25s-13w, 10 miles southeast of St. John. IPP 183 BOPD, plus 4% water, 32°, Lansing Pennsylvanian 3,860-66 ft. TD 4,255 ft. New oil discovery.

Texas

Runnels County:
Williams D. Austin et al. 1 Cecil Lander, 8 miles northwest of Ballinger in Robert Owens Sur. 436. IPF 151 BOPD, 16/64-in. choke, open hole, 46.5°, GOR 650:1, CP packer, Serratt 2,707 ft. TD 2,700 ft. New oil discovery.

Texas Panhandle

Roberts County:
Parsell area discovery. David Beach and D. E. Pinion 1 D. D. Payne, 14 miles west of Canadian in Sec. 162, Blk. 42, H&TC Sur. IPF 297 BOPD, 24/64-in. choke, 44.5°, GOR 1,605:1, FTP 790 psi., Cherokee 9,427-55 ft. TD 10,300 ft. New oil discovery.

West Central Texas

Nolan County:
Jake L. Hamon 1 D. W. Wallace estate, 20 miles southwest of Sweetwater in Sec. 34, Blk. 12, H&TC Sur., 1 mile west of Nena Lucia field. IPP 129 BOPD, Strawn 6,916-32 ft., 42°, GOR 900:1. TD 6,942 ft. New oil discovery.

Wyoming

Sweetwater County, Moxa unit:
Texaco Inc. 1 unit, NE SE 22-19n 112w. IPF 1,300 M.c.f.d., ¼-in. choke, TP 845 psi., CP 1,075 psi., Frontier 11,416-56 ft. TD 14,000 ft. PB 11,500 ft. Frontier discovery, new field.

This announcement is not an offer of securities for sale or a solicitation of an offer to buy securities.

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PROFILE

Comfort can be dangerous

. . . in the opinion of California Oil's Fred Loomis. Best job insurance: a streamlined staff with plenty of work.

IF YOU HAVE a real comfortable job and you're not being pushed too hard, don't feel too pleased about it. This is a good time to start worrying.

Complacency and a relaxed atmosphere often are signs of company inefficiency, and there's nothing more dangerous to a man's job.

This is the firm belief of Fred Loomis, who is just winding up his first year as president of California Oil Co., Western Division, in Denver.

One of management's most important jobs, Loomis feels, is to keep a streamlined organization—for company profits, sure, but also as its obligation to provide both opportunity and security for its employes.

Loomis, at 60, is nearing his thirty-eighth anniversary with the Standard of California organization, and the memory of the depression days of the 1930's may bear on his views. The oil industry in the late '20's had grown "fat and complacent," he says, and the depression forced drastic cuts in personnel.

Fred Loomis
. . . employes like his philosophy.

Organization specialist. His early days with the company also made him something of a specialist in job analysis, wage and salary standardization, and company organization.

He joined Pacific Gasoline Co. in 1924, soon after graduating from Stanford University, and in the next 10 years worked as a roustabout, plant operator, construction foreman, engineer, and maintenance and construction superintendent.

Pacific was bought by Standard of California 3 years after Loomis went to work, and it wasn't long before he was being "borrowed" to help on efficiency studies. This was pioneering work at the time, since there was little in the way of standardization procedures. Too, it was a period of mergers, and absorption of other firms required much in the way of organizational work.

Loomis spent 10 years as an organization specialist—"a job my wife never could explain to her friends," he says—and in 1945 he became assistant manager of the natural-gasoline department. In 1949 he became oil purchase and exchange agent, and in 1954 was named general manager of supply and transportation.

He became vice president of Standard of California's Western Operations, Inc., on January 1, 1957, and in October last year was named president of California Oil Co., Western Division, with headquarters in Denver. The new company, serving the Intermountain West and certain Plains states, is a wholly owned operating company of Standard Oil Co. of California.

Loomis is a soft-spoken man who shies away from publicity. Associates in the Denver office know him as a friendly boss, but one who is very much aware of what is going on.

And they're not worried about being dumped if business falls off. To Loomis, wholesale discharges are a reflection on a company—a sign that it hired a lot more people than it needed.

Western Division employes might feel overlooked at times, but they're pretty sure they're needed. And they approve of Fred Loomis' basic philosophy: "A man's job isn't safe in an inefficient organization."

J. E. Shaw, plant foreman at Arkansas Louisiana Chemical Corp.'s Sligo gasoline plant, Haughton, La., has been promoted to plant superintendent of the Rodessa, La., gasoline plant.

Everett J. Lester, lead engineer with Standard Oil Co. of California, Western Operations, Inc., in Kettleman Hills, Calif., has been promoted to senior engineer, operations, in Coalinga, Calif.

Barney Ryan, head of the supply and distribution department at Humble's Bayway refinery, Linden, N. J., has been given a loan assignment with the manufacturing department of Esso Standard Italiana. **Jim McGrory,** assistant head of the Bayway chemical-products department, will be acting head of supply and distribution there. **Tom Kelly** will succeed McGrory, and **Paul Searl** will succeed Kelly as head of the maintenance division of the mechanical department. Searl's former post of region supervisor in refining and tank field region will be taken by **Tony Mustillo,** region supervisor in chemical products, west side. **Frank Gold,** field engineer in maintenance, will succeed Mustillo.

Tom Boyd, Jr., petroleum engineer with Honolulu Oil Corp. in Midland, Tex., has joined Cabeen Exploration Corp. as production manager in Roswell, N. M.

Five new directors named to the board of National LP-Gas Council are **Kenneth White,** Warren Petroleum Corp., Tulsa; **Daniel E. Hendricks,** Shell Oil Co., New York; **W. L. Hunter,** Pure Oil Co., Palatine, Ill.; **Robert F. Neal,** Mobil Oil Co., Tulsa; and **J. B. Taylor,** Signal Oil & Gas Co., Los Angeles. White will serve on the council executive committee.

PERSONALS

John F. Bookout, Jr., has been named exploration manager of Shell Oil Co.'s Denver exploration and production area. He succeeds **Charles C. Ludwick** who has been given a special assignment within the Denver area. Bookout comes to Denver after several months' assignment in Shell's New York head office. He has served as manager of exploration divisions in Casper, Wyo., and Wichita Falls, Tex. He joined Shell in 1950 in Tulsa.

BOOKOUT

John T. McDonnell has been named manager of export sales for Gulf Oil Corp.'s petrochemical department. He will headquarter in Pittsburgh.

Robert H. McManis has been named manager of light-oil sales for the marketing area of Canadian Husky Oil and its subsidiary, Husky Oil Co. The area extends from eastern Ontario to the Rockies and south to Salt Lake City. McManis had been manager of light-oil sales in the U. S. only. His new assignment is part of a complete reorganization of Canadian Husky and Husky Oil marketing. In other changes, **Dean P. Hunter,** light-oil sales manager in Canada, has been named manager of fuel-oil sales in both countries. Other managers will be **I. W. Sanden,** asphalt sales, Canada; **G. L. Farnsworth,** asphalt sales, U. S.; **S. J. Gardner,** crude and products supply and distribution; **F. Ainsworth,** traffic manager, Canada; and **R. F. Bostock,** manager of direct refinery sales. Five light-oil marketing divisions have been set up. Managers will be **J. A. Mercer,** Billings, Mont.; **J. A. McDonald,** Spokane, Wash.; **J. G. McKenzie,** Edmonton; **N. M. MacDonald,** Regina; and **R. C. Richardson,** Fort William, Ont. The former Great Falls, Mont., and Winnipeg, Man., division offices have been closed. Marketing coordinators in the head office, Calgary, include **D. E. Blunderfield,** TBA sales; **J. H. Jessop,** advertising and sales promotion; **W. H. Brunell,** restaurants; **C. G. Peters,** construction and maintenance; and **W. M. Lupul,** sales analysis, costs, and pricing. The appointments complete integration of Husky's Canadian and U. S. marketing operations.

Lawrence E. Croup, director of process engineering at Gulf Oil Corp.'s Toledo refinery, has been transferred to Philadelphia as director of operations planning and economics at the refinery there.

J. B. Thompson, district superintendent for General American Oil Co. of Texas in Gladewater, Tex., has been transferred to Abilene, Tex., in the same capacity.

C. E. Hahn, managing director of concession affairs for Iraq Petroleum Co. in Baghdad, has been named IPC chief representative in Lebanon. He will headquarter in Beirut. Hahn succeeds **P. R. A. Ensor,** who has retired after 33 years with IPC.

Robert L. Minckler, president of the old General Petroleum Corp., has been elected chairman of the board of trustees of California Institute of Technology. **William M. Keck, Jr.,** California independent, has been named a Caltech trustee and **William C. McDuffie,** Mohawk Petroleum Corp., has been named an honorary trustee. McDuffie has been a board member since 1933 and vice chairman since 1939.

J. W. Culberson, Republic Natural Gas Co., Corpus Christi, Tex., has been elected chairman of the Southwest Texas section of AIME's Society of Petroleum Engineers. Other new officers are **W. C. Lonquist,** Texas Eastern Transmission Corp., first vice chairman; **R. J. Overly,** Humble, second vice chairman; and **S. E. Duerr,** Coloma Oil & Gas Corp., secretary-treasurer. Directors include **K. W. Gilbreath,** Brown Oil Tools, Inc., **C. O. Magee,** Humble; **M. G. McFall,** Camco, Inc.; **Joseph B. Plaza,** Pan American Petroleum Corp.; **John H. Afterbury, Jr.,** Humble; **Jerry M. Brown,** Pan American; **John H. Kay,** Southern Minerals Corp.; and **McGehee Word,** Word Engineering Co.

Myron C. Munson, district scout for Humble in Billings, Mont., has been promoted to area scout in Mattoon, Ill.

Will E. Odom, Austin, Tex., independent, has been named consultant to the House Small Business subcommittee now investigating oil imports.

Jacques Collard, director of crude-oil sales for SN Repal, has been named president directeur general of Union Industrielle des Petroles.

John A. McCone has resigned as a director of Standard Oil Co. of California. McCone recently became director of the U. S. Central Intelligence Agency. He had been a director of California Standard since last January.

Howard J. Grady has been appointed president and manager of the international division of California Chemical Co. **Ernest F. Goodner,** formerly president of American Gilsonite Co., will succeed Grady as president of California Chemical's Ortho division. Both men will serve as vice presidents and directors of California Chemical. Grady has been with Standard Oil Co. of California and its affiliates since 1926. Goodner joined California Standard in 1929.

GRADY

C. H. Chadband, district production foreman in La Habra, Calif., for Union Oil Co., has been promoted to area production superintendent in Santa Fe Springs, Calif.

Arthur L. Hart, Sun Oil Co., has been elected president of Tri-State Association of Petroleum Landmen. **Erl Baxter,** Superior Oil Co., has been named vice president, and **John White,** Humble, has been named secretary-treasurer. Members of the executive committee are **A. H. Emerson,** Sun Oil Co.; **N. F. Murphy,** Phillips Petroleum Co.; **A. W. Austin,** Ohio Oil Co.; **C. S. Morris,** Continental Oil Co.; and **Fred Pattillo,** T. & H. Corp.

W. A. Scott, exploitation engineer in Shell Oil Co.'s head office exploration and production department, New York, has been transferred to the Houston area as chief exploitation engineer. He succeeds **R. L. Ferris,** recently named Corpus Christi, Tex., division production manager. Scott has been with Shell since 1946. He was senior exploitation engineer in Denver before moving to New York in 1959. He also served on assignment in The Hague in 1959.

SCOTT

Dr. Jan J. Hermans has joined Chemstrand Research Center, Inc., as senior staff scientist.

D. A. Limerick, assistant superintendent of Shell Chemical Co.'s Torrance, Calif., synthetic rubber plant, has been transferred to Marietta, Ohio, as superintendent of operations at Shell's new synthetic rubber plant there. Limerick has been with Shell Chemical since 1943.

Guy W. Goodman, maintenance foreman at Pacific Gas & Electric Co.'s Topock compressor plant, Needles, Calif., has been transferred to Klamath Falls, Ore., and promoted to district foreman for Pacific Gas Transmission Co.

Brodie D. Chandler, chief engineer at the Sand Springs, Okla., pump station of Texaco-Cities Service Pipe Line Co., has retired after 32 years with the company.

M. E. Gipson, first engineer for United Gas Pipe Line Co. in Hattiesburg, Miss., has been promoted to chief engineer in Mineola, Tex.

H. Dewey Mathias, foreman of the southern pipeline division in Ohio Fuel Gas Co.'s transmission department at Sugar Grove, Ohio, has retired after 44 years with the company.

F. H. Cummins, senior inspector with Shell Pipe Line Corp. in Houston, has been transferred to Harvey, La., as material expediter.

Ted Cook, geologist with Shell Oil Co., will be transferred to Coral Gables, Fla., from Corpus Christi, Tex., February 1.

Jerry C. Brownfield, measurement engineer with Brazos Oil & Gas Co. in Bay City, Tex., has been promoted to staff engineer in Houston.

James K. Lawson, district superintendent of drilling and production for Superior Oil Co. in Chickasha, Okla., has been transferred to Casper, Wyo., in the same capacity.

J. L. Hiller, Jr., assistant Charlotte, N. C., division manager for Humble, has been named Charlotte area marketing manager. Hiller was assistant southern region manager in New York before moving to Charlotte in 1958.

Albert D. Littlejohn, Sr., North Georgia marketing district manager for Pure Oil Co., has been promoted to Atlanta area manager. **Boyd C. Lyon,** Atlanta area sales manager, will succeed Littlejohn. **E. E. Palmer,** reseller sales manager in Atlanta, has been named area sales manager. **J. C. McMullan,** Rome, Ga., sales representative, has been transferred to Atlanta as reseller representative.

Eduardo Acosta has resigned as director of the technical office of hydrocarbons in the Venezuelan Ministry of Mines and Hydrocarbons. He will continue as a consultant to the ministry. The change had been expected for several weeks (OGJ Newsletter, Oct. 16). Acosta, a University of Texas graduate, left consulting work in Caracas in 1959 to take the ministry post.

Jack K. Letts, Atlantic Refining Co., Durango, Colo., has been elected president of Four Corners Association of Petroleum Landmen. Other new officers are **Thomas S. Cate,** Shell Oil Co., Durango, vice president, and **Ed Norton,** El Paso Natural Gas Products Co., Farmington, N. M., secretary.

Charles S. Coates has been named president and chairman of Southwest Gas Pipeline Co., new firm organized to gather and sell natural gas to Texas industries and to operate gas facilities. **John L. Weiler,** president of Southwest Gas Gathering Co., will be vice president of the new company. Southwest Gas Gathering, owner of gas gathering systems in Jefferson and Victoria counties, Texas, has been merged into the new firm. Coates is a former president and chairman of Trans-Canada Pipe Lines, Ltd. He also had been a senior vice president of Tennessee Gas Transmission Co.

COATES

Ed W. Hughston has been named manager of the oil and gas division of Diversa, Inc., Dallas.

Donald I. Lawless, former president and director of Bishop Oil Co., has opened offices in San Francisco as petroleum consultant.

Paul M. Laird, geologist with Sinclair Oil & Gas Co., has been transferred to Jackson, Miss., from Houston.

Kenneth Harding, district geologist for Texaco, has been transferred to Billings, Mont., from Bismarck, N. D. **Paul A. Guttormsen** will succeed Harding in Bismarck.

Charles H. Glidden, formerly division geologist in Tulsa for Union Oil Co. of California, has been transferred to Midland, Tex., as chief geologist for Union's central division. He succeeds **Robert L. Clarke,** who has been given an assignment at the company's Los Angeles general offices.

Hugh D. Guthrie, manager of the alkylation department at Shell Oil Co.'s Wood River, Ill., refinery, has been transferred to Shell's head office in New York as assistant to the manager of the products-availability and economics department. **F. A. M. Buck,** assistant manager of the Wood River alkylation department, will succeed Guthrie as manager.

Calon E. Blackburn has joined Wheeler & Ryan, Tulsa oil and gas exploration firm, as exploration manager. He will headquarter in Tulsa. Blackburn had been with Sinclair Oil & Gas Co.'s land department since 1957. He recently had been located in Wichita and, before that, in Tulsa.

W. P. Knick, district foreman in Taft, Calif., for Union Oil Co., has been transferred to Bakersfield, Calif., as area superintendent.

E. E. Oliver, contract manager for Delta Drilling Co., Denver, has joined Tradewinds Exploration, Inc., in Denver in a similar capacity. Tradewinds plans to set up headquarters soon in Casper, Wyo., with **E. B. Mays,** vice president and general manager, located there.

L. V. Whittington has been promoted to assistant drilling superintendent of Zapata Off-Shore Co. with headquarters in Houston. Whittington will direct rig operations in the Louisiana-Texas Gulf area and the Persian Gulf.

S. B. Stewart, production engineer at the Bronte, Ont., refinery of Cities Service Refining (Canada), has been named chief engineer there. He succeeds **C. E. Chiasson,** who has joined Petroquimica Argentina, SA, an affiliate.

Domestic product-supply group of Gulf Oil Corp. has been transferred from Pittsburgh to operational headquarters in Houston. The recently reorganized group is headed by **James N. McGarvey,** manager. The staff includes **M. O. Boyd,** manager of distribution; **R. M. Adams,** director of planning; **A. G. Copp,** director of supply arrangements; and **J. G. Walker,** director of finance and services.

Seymour M. Zivan, engineer in Shell Oil Co.'s exploration and production department, New York, has joined Humble as engineer at the Bayway refinery, Linden, N. J.

Warren H. Kraft, vice president of Honolulu Oil Corp. in San Francisco, has moved to Los Angeles as gas activities coordinator for Tidewater Oil Co.

A. H. Mizell III, vice president and general manager of Ingram Oil Co. in New Orleans, has moved to Nashville, Tenn., as retail manager of Murphy Corp.'s central region. Ingram was recently merged into Murphy Corp.

H. L. Olson has been named assistant New Orleans district superintendent for Pan American Petroleum Corp. He is returning to Louisiana after 3 years in Iran as head of producing operations for Pan American International Oil Corp.

DEATHS

Charles R. Rider, 66, Dallas, chairman of Drilling & Exploration Co., Inc., and its subsidiaries, died November 18 in New York City after a heart attack. Rider helped found Drilling & Exploration in 1929. He left the company in 1946 to become president of Twin Oil Corp., Dallas. Twin Oil was merged with Drilling & Exploration in 1954 and Rider became chairman. He served as president from 1957 until this year, when he again became chairman.

Oliver H. Dawson, 69, retired senior research chemist for Humble in Baytown, Tex., died November 12 while on a visit to Shreveport, La. Dawson retired in 1957 after 35 years with Humble.

Dr. William Allen Hamor, 74, retired senior director of research for Mellon Institute, died November 23 after several months' illness.

Edward C. Lawson, 56, president of Lawson Petroleum Co., died November 24 at his home in Tulsa after suffering a heart attack. Lawson had been active as an independent operator since the 1920's. He organized Lawson Petroleum with his father, the late Eugene B. Lawson, pioneer Oklahoma oil man. He had been active in industry associations, serving at one time as chairman of a group of independents working on a proration program for Oklahoma.

Francis A. Blackburn, construction engineer for Standard Oil Co. of California, died November 23 at his home in Bakersfield, Calif.

Fayburn L. Fox, 67, retired vice president of Ohio Oil Co., died November 18 in Findlay, Ohio, after suffering a heart attack. Fox retired in 1959 after 44 years with Ohio.

Edgar J. Dowling, 49, senior analyst in market research for Gulf Oil Corp., died November 15 at his home in Houston.

James Henry Dearin, Jr., 75, pioneer Kern County, California oil man, died November 17 at his home in San Francisco.

Harold W. Healy, 72, president of Rocky Mountain Oil & Gas Association in 1955, died recently in Casper, Wyo. Healy went to Casper in 1934 as legal counsel for Ohio Oil Co. He retired as Ohio division manager in 1954 and returned to private law practice.

Harold M. (Bob) Hatfield, oil production superintendent in North Texas for Trumter Petroleum Corp., Fort Worth, died November 20 in a Gainesville, Tex., hospital after a heart attack.

Leonard Clark White, 84, retired Friendly W. Va., producer, died November 19 at his home in Friendly.

Virgil Hicks, 89, retired Tulsa oil man, died November 22 in Tulsa after a long illness.

George L. Skelly, 75, retired supervisor of accounting for South Penn Oil Co., died November 21 at his home in Oil City, Pa.

Aubrey (Gus) Wardman, 84, California oil producer in the Santa Fe Springs area, died November 22 in a Whittier, Calif., hospital.

Harry Failing, 70, former Tulsa drilling contractor, died November 25 while visiting relatives in Sapulpa, Okla.

High capacity, high runs, high stocks, low prices

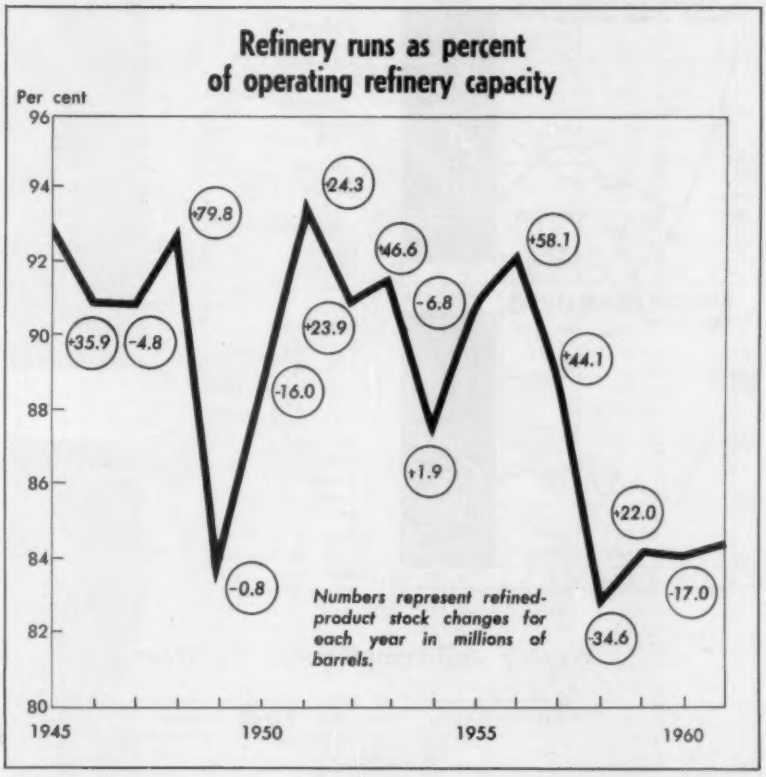
BY JOHN C. CASPER

FOR THE PAST 4 years, refinery runs have been below 85% of operating capacity each year.

Low operating ratios can be caused by excess capacity, low runs, or both. Runs have not been low for the period. Proof lies in the fact that product stocks at the end of this year will be about 2.2 times the total in storage at the end of 1945.

Unless the weather is very cold in December, product stocks will show a gain of about 15 million barrels for the year. The net increase for the past 5 years will be near 29 million barrels. These stock gains show that runs have not been low enough to cause serious shortages. In fact, the trend has been more toward surplus than shortage.

The chart gives a picture of refinery runs each year, expressed as per cent of operating capacity. Operating capacity is total refining capacity minus shutdown capacity.



Circled numbers on the chart represent refined-product stock changes each year in millions of barrels. In most cases, high operating ratios have resulted in substantial additions to product storage. For the years when refinery runs were above 90% of capacity, there were only two with stock decreases.

Refinery runs this year will average about 85% of capacity. Product stocks will gain about 15 million barrels.

The table shows annual changes in several of the supply-demand factors in the postwar period. There were only three reductions in product imports, three decreases in demand, and four cuts in refinery runs. The 16-year gain in product stocks amounts to about 290 million barrels. Some of those barrels have added to pressure on product prices.

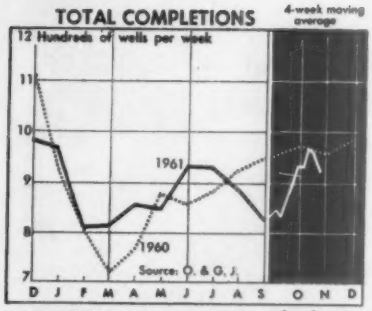
Changes in supply-demand factors (Thousands of barrels daily)

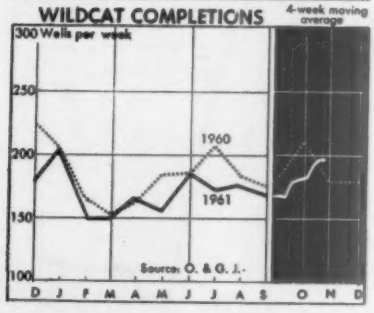
	Total demand	Refinery runs	Product imports	Product stocks
1946	—27	29	33	99
1947	571	335	28	—13
1948	241	474	—8	218
1949	—13	—222	63	—2
1950	682	412	139	—44
1951	663	755	—9	66
1952	237	176	26	65
1953	293	330	6	128
1954	110	—42	10	5
1955	712	522	70	—19
1956	382	457	36	159
1957	177	—18	50	121
1958	—28	—277	195	—95
1959	304	332	67	60
1960	201	73	—10	—46
1961	110	103	31	41

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,192,530	DOWN	17,030	UP	42,022
Crude stocks	250,908,000	UP	2,894,000	UP	13,872,000
Completions	820	DOWN	142	DOWN	123
Refinery runs	8,303,000	UP	133,000	UP	211,000
Gasoline stocks	183,706,000	UP	1,605,000	DOWN	4,200,000
Kerosine stocks	36,630,000	UP	39,000	DOWN	469,000
Distillate stocks	177,543,000	DOWN	940,000	UP	1,802,000
Residual stocks	48,732,000	UP	36,000	DOWN	76,000
Four-product stocks	446,611,000	UP	740,000	DOWN	2,943,000
Total imports	1,791,800	UP	22,900	DOWN	84,000

Drilling





Active rotary rigs

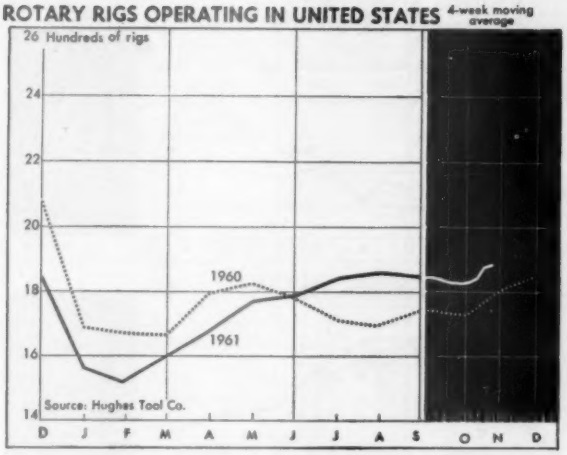
	11-27-61	11-20-61	11-28-60
Alabama	7	5	5
Alaska	9	7	8
Arkansas	15	17	10
Arizona	2	2	1
California	112	108	74
Land	107	102	71
Offshore	5	6	3
Colorado	33	33	43
Florida	1	1	4
Land	0	1	2
Offshore	1	0	2
Illinois	44	47	33
Indiana	7	7	8
Iowa	0	0	0
Kansas	99	115	129
Kentucky	4	6	6
Louisiana	302	303	274
North	44	45	35
S. Inland waters	110	103	104
S. Land	90	97	79
Offshore	58	58	56
Michigan	24	24	32
Mississippi	68	62	45
Missouri	0	2	1
Montana	25	25	20
Nebraska	30	25	25
Nevada	1	1	0
New Mexico	106	103	114
New York	2	2	2
North Dakota	18	16	11
Ohio	7	6	5
Oklahoma	196	198	200
Pennsylvania	7	8	6
South Dakota	0	1	1
Tennessee	0	1	0
Texas	640	644	657
S. Inland waters	15	13	5
S. Land	173	174	185
Offshore	3	2	0
North	66	63	56
Panhandle	43	42	61
East	66	68	47
West Central	168	178	176
West	106	104	127
Utah	44	42	30
Washington	1	1	1
West Virginia	14	14	6
Wisconsin	0	0	1
Wyoming	73	79	64
Total U. S.	1,891	1,905	1,816
Cum. avg. to date	1,741	1,738	1,739
Western Canada	135	159	141
Eastern Canada	1	1	0
Grand total	2,027	2,065	1,957

Hughes Tool Co. report.

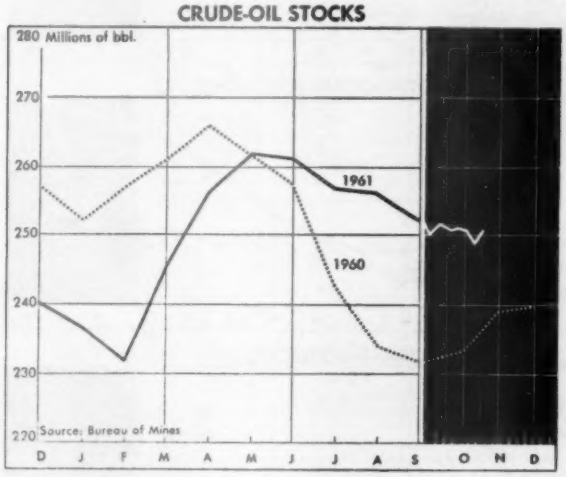
Weekly well completions . . . Week ended November 25, 1961

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Arkansas	15	9	0	0	3	3	45,386	473	550	0	0	0	0	0	99	137
California	41	29	0	2	9	1	151,826	1,675	1,533	7	0	0	0	7	249	274
Colorado	13	2	0	2	9	0	64,158	603	601	6	0	0	0	6	268	303
Illinois	40	18	0	0	20	2	90,203	1,856	2,132	11	4	0	0	7	434	450
Indiana	20	7	0	0	13	0	31,013	705	973	6	0	0	0	6	194	347
Kansas	45	27	0	2	16	0	175,326	4,269	3,759	8	2	0	0	6	791	945
Kentucky	12	2	0	0	9	1	16,385	1,634	1,977	0	0	0	0	0	116	213
Louisiana	109	61	1	11	36	0	831,106	3,542	3,307	18	2	0	1	15	604	507
North	43	26	1	4	12	0	135,264	1,510	1,296	5	0	0	0	5	292	245
South	62	33	0	6	23	0	661,215	1,559	1,556	12	2	0	1	9	261	231
Offshore	4	2	0	1	1	0	34,627	473	455	1	0	0	0	1	51	31
Michigan	24	3	0	1	14	6	61,902	740	861	7	0	0	0	7	261	233
Mississippi	16	12	0	2	2	0	158,033	514	612	1	1	0	0	0	179	236
Montana	7	3	0	0	4	0	36,374	367	312	3	0	0	0	3	170	146
Nebraska	17	5	0	0	12	0	78,786	895	802	11	0	0	0	11	446	352
New Mexico	28	11	1	10	6	0	165,467	1,638	1,696	2	0	0	0	2	268	236
West	13	0	1	10	2	0	66,853	713	617	2	0	0	0	2	91	67
East	15	11	0	0	4	0	98,614	925	1,079	0	0	0	0	0	177	169
North Dakota	3	3	0	0	0	0	27,335	234	262	1	1	0	0	0	67	76
Ohio	25	14	0	5	6	0	69,105	973	975	1	0	0	0	1	40	46
Oklahoma	69	26	0	13	26	4	362,619	5,201	4,196	6	0	0	1	5	480	635
Texas	284	147	3	19	106	9	1,378,104	13,054	14,110	67	7	0	0	60	2,809	2,891
Dist. 1	14	10	0	0	4	0	26,109	837	1,013	3	0	0	0	3	323	363
Dist. 2	18	6	0	3	9	0	104,524	696	685	7	0	0	0	7	212	170
Dist. 3	41	12	0	4	23	2	298,693	1,050	1,067	13	0	0	0	13	219	205
Dist. 4	12	5	0	2	5	0	79,152	1,095	976	5	1	0	0	4	308	267
East	22	11	3	0	8	0	135,892	1,042	1,190	3	0	0	0	3	270	245
Dist. 7-B	25	14	0	3	7	1	83,939	1,602	1,992	4	1	0	0	3	445	562
West	82	50	0	3	28	1	426,410	3,278	3,614	24	3	0	0	21	651	571
Dist. 9	58	32	0	1	20	5	165,762	2,398	2,618	6	1	0	0	5	263	455
Dist. 10	12	7	0	3	2	0	57,623	1,056	955	2	1	0	0	1	118	53
Utah	4	3	0	0	1	0	22,653	217	215	1	0	0	0	1	100	81
West Virginia	32	3	0	25	4	0	79,125	936	774	0	0	0	0	0	7	9
Wyoming	13	1	0	1	10	1	60,155	891	964	8	0	0	0	8	346	390
Misc. (Ariz. Alaska)	3	1	0	0	2	0	22,554	1,234	1,187	2	0	0	0	2	247	216
Total U. S.	820	387	5	93	308	27	3,927,615	41,651	41,798	166	17	0	2	147	8,175	8,723
Previous week	962	416	5	145	359	37	4,269,805			209	20	0	8	181		
Cum. 1961	41,651	18,685	723	4,334	15,152	2,757	170,565,259			8,175	727	81	365	7,002		
Cum. 1960	41,798	18,845	1,211	3,526	15,837	2,379	172,045,574			8,723	789	96	294	7,544		
Western Canada	74	47	0	8	19	0	354,625	2,109	2,082	14	2	0	2	10	484	545

ROTARY RIGS OPERATING IN UNITED STATES 4-week moving average



CRUDE-OIL STOCKS



Crude-oil stocks by states of origin*

(Thousands of barrels)

	11-18-61	11-11-61	11-19-60
Pennsylvania	2,275	2,291	2,310
Other Appalachian	1,394	1,362	1,323
Illinois, Indiana, Michigan	9,446	9,681	9,164
Nebraska and North Dakota	3,060	3,054	2,686
Kansas	9,476	9,267	8,985
Oklahoma	17,621	16,795	15,582
Arkansas	1,616	1,760	1,822
Louisiana	19,831	19,357	18 438
North	3,253	2,918	3,307
South	16,578	16,439	15,131
Mississippi, Alabama, Florida	3,676	3,271	2,038
New Mexico	10,766	9,609	8,778
Texas	105,497	104,770	99,453
East Texas	8,003	8,272	7,436
West Texas	47,313	47,133	46,882
Texas Gulf	18,928	18,982	17,555
Other Texas	31,253	30,383	27,580
Wyoming	16,403	16,333	15,592
Other Rocky Mountain	10,214	10,177	10,421
California	23,599	23,322	25,684
Foreign	†16,034	16,965	14,760
Total	**250,908**	248,014	237,036

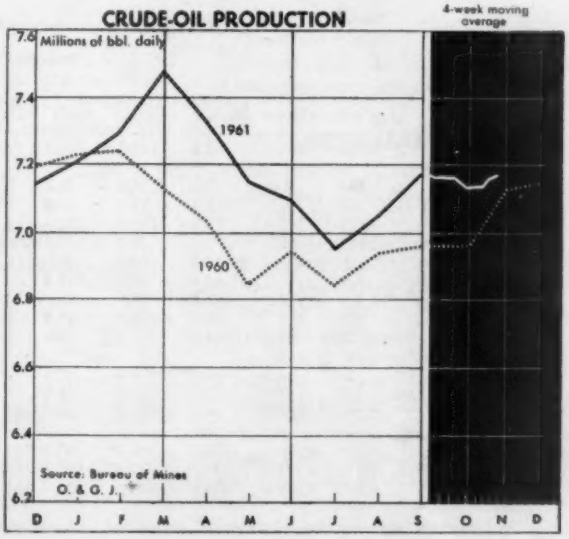
*Bureau of Mines. †Includes 3,975,000 bbl. in California.

Daily average production for week

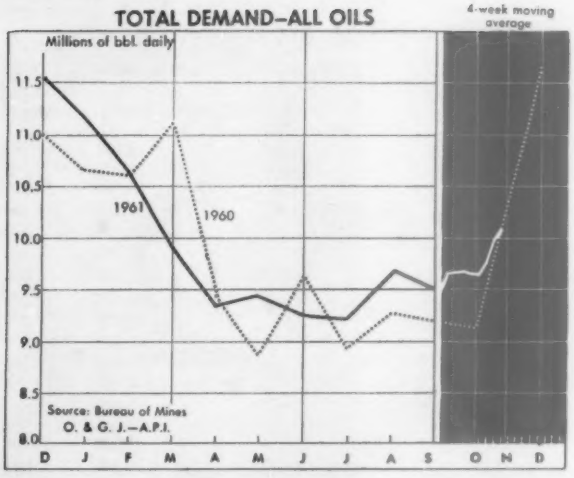
	November 25, 1961 Crude oil	Lease condensate	Total	Nov. 18 total
Alabama	18,750	.....	18,750	18,750
Alaska	26,000	.....	26,000	25,500
Arkansas	78,900	150	79,050	79,050
California	817,800	.....	817,800	817,500
Colorado	126,100	.....	126,100	127,000
Eastern	41,100	.....	41,100	40,200
Florida	1,000	.....	1,000	1,000
Illinois	221,100	.....	221,100	220,200
Indiana	30,800	.....	30,800	30,900
Kansas	†302,930	.....	†302,930	†305,035
Kentucky	51,400	.....	51,400	51,700
Louisiana	1,045,000	165,750	1,210,750	1,210,750
Michigan	52,600	.....	52,600	52,600
Mississippi	146,000	4,200	150 200	150,200
Montana	87,100	.....	87,100	88,700
Nebraska	71,000	.....	71,000	71,200
Nevada	450	.....	450	450
New Mexico	310,000	9,000	319,000	319,000
North Dakota	58,750	.....	58,750	56,900
Oklahoma	†506,200	.....	†506,200	†515 000
Texas	2,430,000	93,800	2,523,800	2,523,800
Dist. 1	43,000	2,900	45,900	45,900
Dist. 2	106,000	8,000	114,000	114,000
Dist. 3	306,000	38,000	344,000	344,000
Dist. 4	177,000	14,000	191,000	191,000
Dist 5	26,000	850	26,850	26,850
Dist. 6	117,000	8,500	125,500	125,500
East Texas field	128,000	.....	128,000	128,000
Dist. 7-B	120,000	500	120,500	120,500
Dist. 7-C	107,000	3,550	110,550	110,550
Dist. 8	1,000,000	13,000	1,013,000	1,013 000
Dist. 9	195,000	2,500	197,500	197,500
Dist. 10	105,000	2,000	107,000	107,000
Utah	90,500	.....	90,500	91,400
Wyoming	405,300	.....	405,300	411,900
Others	‡850	.....	‡850	‡825
Total U. S.	6,919,630	272,900	**7,192,530**	7,209,560
Change from previous week, down			**17,030**	
Canada	†662,800	†17,500	†680,300	†663,800
Total U. S. Prod.-Jan. 1-Nov. 25			2,365,681,210 bbl.	
Same period last year (crude plus cond.)			*2,317,583,800 bbl.	

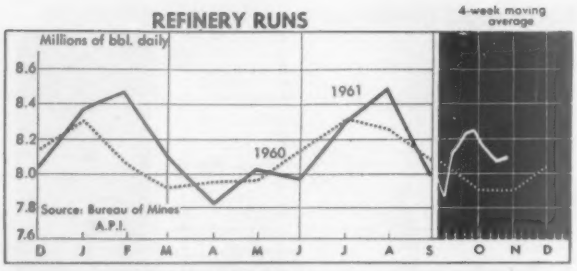
*Includes 74,599,440 bbl. condensate. †Week ended previous Monday. ‡South Dakota, Arizona, Missouri.

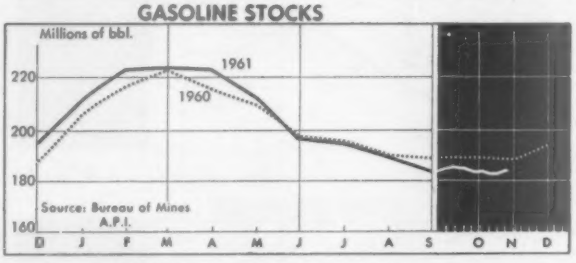
CRUDE-OIL PRODUCTION 4-week moving average

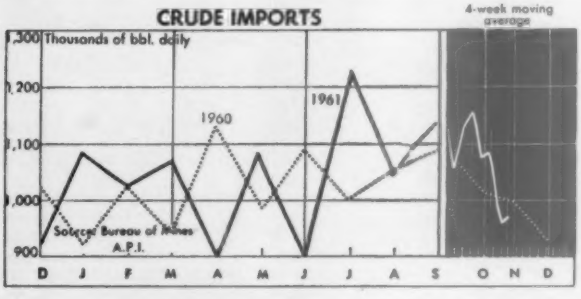


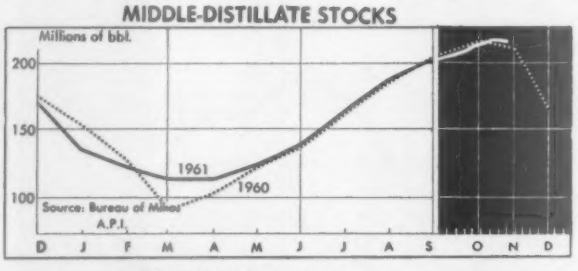
Refining

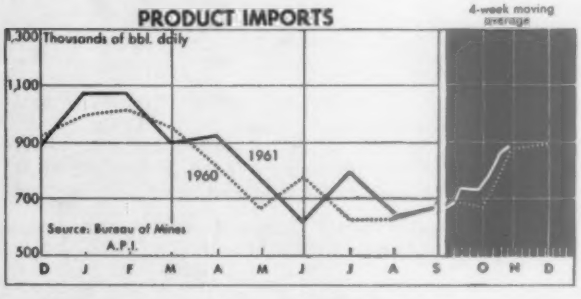


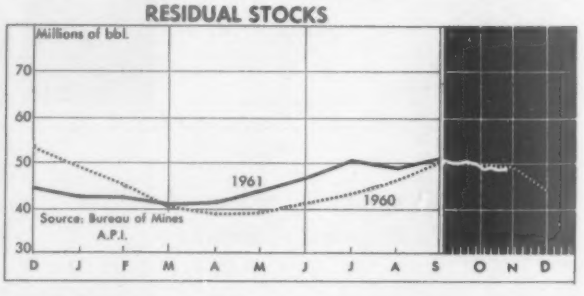












API refinery report—November 24, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, November 1960 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,104	474.7	42.2	385.9	147.4	42 915	15,240	71,518	14,380	1,062	503.8	34.1	332.7	145.4
Appalachian:														
District 1	104	45.4	7.1	24.3	25.4	5,788	750	4,337	425	98	39.9	4.1	19.9	11.8
District 2	100	57.2	8.2	17.3	13.2	3,145	461	1,904	230	102	52.7	7.2	18.7	12.4
Ind., Ill., Ky.	1,521	741.4	77.6	295.4	184.4	31,141	7,263	30,587	5,727	1,429	735.5	80.4	313.5	167.4
Minn., Wis., Dak.	115	58.2	8.7	24.1	13.2	6,828	1,890	8,536	554	115	55.0	5.3	27.1	22.0
Okla., Kans., Mo.	706	433.3	19.7	160.9	20.0	16,276	1,751	13,270	1,005	706	410.9	11.0	176.5	19.3
Inland Texas	300	217.2	13.0	49.6	18.4	7,142	627	1,664	2,826	274	214.6	9.7	45.3	18.7
Texas Gulf Coast	1,904	974.3	142.4	490.7	128.0	24,014	3,451	18,016	5,164	1,881	968.9	140.1	457.8	135.7
La. Gulf Coast	729	413.7	62.3	176.7	45.3	9,291	1,809	7,454	1,281	645	358.7	73.0	143.5	39.9
N. La. and Ark.	113	63.4	4.6	27.0	6.9	6,061	859	2,644	207	108	68.2	5.8	21.4	7.3
Rocky Mountain:														
New Mexico	26	14.4	0.4	4.4	2.1	754	33	241	94	22	11.7	0.3	3.9	2.7
Other Rocky Mt.	286	139.6	5.7	68.2	36.4	5,197	537	2,470	1,193	280	140.9	3.5	67.7	33.6
West Coast	1,295	587.7	56.4	239.4	266.7	25,154	1,959	14,902	15,646	1,171	527.9	38.9	201.3	287.6
Nov. 24, 1961	8,303	4,220.5	448.3	1,963.9	907.4	183,706	36,630	177,543	48,732	7,893	4,088.7	413.4	1,829.3	903.8
Nov. 17, 1961	8,170	4,151.9	388.3	2,027.3	827.6	182,101	36,591	178,483	48,696	.....	.....	.....	.....	.....
Nov. 25, 1960	8,092	4,110.9	444.0	1,909.6	893.9	187,906	37,099	175,741	48,808	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES

Gravity schedule

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver-Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	†$2.35	$2.61	$2.29	$2.95	$2.90	‡$2.38	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.40	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.42	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.44	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.46	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.48	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.50	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.52	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.54	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.56	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.58	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.60	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.62	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.64	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.66	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.68	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.70	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.72	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.74	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.76	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.78	2.95

*Cooke, Grayson, Montague. †Other posting starts at $2.55. ‡Some at 2.58.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.10-3.25
Conroe	3.23-3.53
Van	2.93-3.08
Pennsylvania Grade:	
Bradford	$4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Buckeye Grade	4.08
Illinois Basin	**3.00**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0°-34.9°, Ras Tanura	$1.80
Iranian, 34.0°-34,9°, Bandar Mashur	1.78
Iranian, 34.0°-34.9°, Abadan	1.73
Iraq, 35.0°-35.9°, Fao	1.72
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.59
Qatar, 41°-41.9°, Umm said	1.95
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.19
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 36°	2.42
Canada:	
Leduc-Woodbend	$2.63
Redwater (Alta.)	2.52
Weyburn (light)	2.185
Midale C	1.89
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Price for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long ton)

(Latest reported spot fixtures)

Gulf-NY, clean (ATRS+15%)	$3.28
Carib.-NY, dirty (ATRS – 45%)	1.51
Carib.-UK, dirty (Scale – 55%) (14s. 7d.)	2.05
PG-UK, dirty (Scale – 60%) (21s. 8d.)	3.04
PG-Japan, dirty (USMC – 73.5%)	2.70

★ Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refinenrs' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	10.25-10.50
Premium (99 octane)	13.00-13.25
†Natural gasoline (26-70)	4.5
†Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements): movements):	
Regular (90 octane)	10.50-11.00
Regular (92 octane)	10.75-11.25
Premium (98 octane)	11.75-12.25
California (rack) Los Angeles:	
Regular (90 octane)	11.20
Premium (94 octane)	12.20
Premium (100 octane)	13.35
Caribbean area (cargoes):	
Regular (87 octane)	9.00
Premium (97 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	10.00-10.25
★ Diesel oil (58 d.i. and above)	9.50- 9.75
★ Distillate No. 1	9.50- 9.75
★ Distillate No. 2	8.75- 9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.75
Distillate No. 2	8.75
New York Harbor (barges):	
Kerosine 42-43	11.20
Distillate No. 2	10.20
Diesel fuel, 48-52 d.i.	10.35
Caribbean area (cargoes):	
Distillate No. 2	8.10

RESIDUAL FUEL

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.65-1.75
Gulf Coast (cargoes):	
Bunker C fuel	2.20
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C fuel	2.00
California (rack):	
Bunker C fuel, Los Angeles	2.25

†Due to the decline in market for Grade 26-70 natural gasoline, The Oil and Gas Journal will discontinue publication of prices for this grade of natural gasoline at the end of 1961.

CLASSIFIED ADVERTISING

. . . your market place for the oil and gas industry

RATES:

- UNDISPLAYED CLASSIFIED: 30c a word per issue. 10% discount for three or more consecutive issues. $5.00 minimum charge. Blind box in care count nine extra words. Not subject agency commission.
- DISPLAYED CLASSIFIED: $20 a column inch one issue, 10% discount three or more consecutive issues. Minimum size one inch. Subject to agency commission.
- All classified payable in advance.
- DEADLINE: Copy to reach The Oil and Gas Journal not later than 9 a. m. on Wednesday preceding date of publication. Send advertisements to: Classified Advertising Manager, THE OIL AND GAS JOURNAL, P. O. Box 1260, Tulsa 1, Oklahoma.

EXCEPT . . .

WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc. The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287. Copy deadline Monday noon.

FOR SALE EQUIPMENT

20,000 FEET 4½" O.D. used 10.79# double random pipe, PE and beveled for welding, tested 1000#, priced reasonable. Call CE 5-1454, Oklahoma City, collect.

50,000 FT. 20 inch No. 1 grade used pipe. Lengths 20 ft. square cut ends. Weight 78# to the ft. High Tensile Pipe. Indiana-Ohio Pipe Co., P. O. Box 5462 Shep. Sta., Columbus 19, Ohio. Phone CL 3-5527—CL 3-5528.

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

2500 FAILING, 5 x 8 pump, 58' mast. Failing 1500, Howard Turner, complete. Fred Butler, Box 481, Pueblo, Colo.

2,000'—24" OD New, ¼" Wall
Prime Pipe, 50', B.F.W., P.E.
@ $_____
10,000'
18" x ⅜" ditto
@ $_____
Prompt Shipment From Stock
F.O.B. Columbus, Ohio
Columbus Steel Supply Company
1000 Bonham Avenue
Columbus 3, Ohio AX 4-4461

FOR SALE:

4—36-L Bucyrus Erie drilling machines skid mounted Waukesha engines.
1—1957 model W 226 Cooper two drum servicing unit with spudding attachment, air clutches 8 x 10 mast, mounted on International Tandem truck
1—1955 model Franks junior drum servicing unit with 7 x 8 mast mounted on a Studebaker truck
1—Franks 5,000 single drum servicing unit, air clutch, 5 x 7 double pole mast mounted on L-192 International Tandem truck.
These units are in good operating condition and are priced for quick sale.

Degen Pipe & Supply Co.
4900 Sapulpa Road, Tulsa, Oklahoma
Phone HIckory 6-6152

LIQUIDATION

at ESSO REFINERY Balto., Md.

MOST EQUIPMENT NEW 1956

TOWERS	• COMPRESSORS
DRUMS	• BLOWERS
FURNACES	• TRANSFORMERS
PUMPS	• MOTORS
CONDENSERS	• FURNACE TUBES

WRITE FOR CATALOG

HEAT & POWER CO., INC.
60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.

FOR SALE EQUIPMENT

USED GAS PROCESSING Equipment; Glycol and Dry Dessicant Dehydrators; Quick-cycle Hydracarbon Recovery Units; Water Flood Filter-pump Units. Also new oil and gas production equipment. Engineered Specialties Co., P. O. Box 35683, Phone FL 1-5284, Dallas 35, Texas.

10,000' ROTARY RIG—USED

MC 450 Bethlehem Drawworks; 3—LRO gas-butane power; 129' LCM Mast; National C-350, Bethlehem G-300 pumps; 300 ton Ideco Block; BJ 4,300 Hook; 26½" Table; 150 Ton Swivel-Less Drill Pipe Drill Collars, otherwise complete. Can furnish pipe separately.

Odessa, Texas

LUCEY PRODUCTS CORPORATION
Tulsa, Okla.—LU 4-4711

AT N. LITTLE ROCK, ARKANSAS

3—Worthington #L T C-4, compressors, 3500 CFM @ 45 PSI, 24 x 15, 2-cyl., 500 HP, 4-cycle, gas-engine drive.

Phone POplar 3-3565

PERRY EQUIPMENT CORP.
1402 N. Sixth St.
Philadelphia 22, Pa.

90,000 feet
of 8⅝" O.D. 28.55#
P.E. #1 Used line pipe
located near Ada, Oklahoma.
Phone: 425-2447
A. A. Gilbert Pipe & Supply Co.
P. O. Box 986, Shreveport, Louisiana

PERFORATING & LOGGING EQUIPMENT

- **HOIST UNITS**
  NEW AND USED
- **LOGGING EQUIPMENT**
  ELECTRIC, GAMMA, NEUTRON, TEMPERATURE
- **PERFORATING**
  GUNS AND SUPPLIES
- **PLUGS**
  SETTING TOOLS, PLUGS, PACKERS AND DUMP BAILERS

FOR CATALOG AND PRICES WRITE TO:

GO PERFORATOR SUPPLY
Box 1936, Fort Worth, Texas
FOREIGN AND DOMESTIC SALES

FOR SALE EQUIPMENT

LARGE SCINTILLOMETER and recorder. 5" Crystal—115V. Truck Mounted. Leonard Combs, 1115 South Quebec, Tulsa 12, Okla.

4—5¾" x 50' and 1—4½" x 50' core barrels with all spare parts and equipment. All equipment in excellent condition. Box M-630, The Oil and Gas Journal, Tulsa, Oklahoma.

(6) 96,000 Bbl. 120'x48'

WELDED CONE ROOF
OIL STORAGE TANKS
INSTALLED NEW in 1952
Dismantled, Matchmarked For
Reerection $75.00 N.T.
FOB Baltimore, Md.

HEAT & POWER CO., INC.
60 East 42nd St., New York 17, N.Y.
Boston & Haven Sts., Baltimore 24, Md.

ANOTHER LARGE AUCTION

PAN AMERICAN TOOL COMPANY
VENICE, LOUISIANA

A Complete
rental tool company

Sale to be held on the premises, Venice, Louisiana, December 12, 1961 at 10:00 A.M. Inspection of equipment beginning December 7th until sale starts.
In excess of $500,000 acquisition cost including:
DRILL PIPE-DRILL COLLARS—KELLYS—ELEVATORS—SLIPS-TONGS-B.O.P.

Drill Pipe
25,000' 13.3#—3½" DP—E—Rge 2—EU & IU with TJ.
24,500' 10.4#—2⅞" DP—E—Rge 2—EU
Drill Collars 4¾"—4⅛"—4"
Kellys 3½" & 3"
Elevators 10¾" BJ 200 ton casing elevators; 3½" & 2⅞" BJ & Wilson bottle neck & Sq. shoulder elevators.
Slips 9⅝"—8⅝"—7"—5½"
Blow Out Preventers 4½"—3½"—2⅞" Gray inside BOP with setting tool
Miscellaneous
Tongs—Safety Joints, Safety Clamps, Nipples, Kelly drive bushings, Casing testers—drill pipe protectors and many other items too numerous to list.

For complete listing write auctioneers for brochure

Wayne Cook Associates, Inc.
"The Nation's Leading Auctioneers"
193 Meadows Building, Dallas 6, Texas
EM 3-3388

FOR SALE EQUIPMENT

FOR SALE RA-3 and RA-4 Clark compressors. Alfred B. Kern, 305 Kennedy Bldg. Tulsa, Oklahoma.

SIE, 24 TRACE, dual record, GA7-G Seismic system complete. Mounted on 1958, 2 ton Chevrolet truck, front end winch. Other equipment also available. Texas Seismograph Co. Box 2069, Phone 723-1493, Wichita Falls, Texas.

1—XOB Ingersoll-Rand Compressor with 2—10" cylinders. 1—970 Buda 6 cylinder gas engine. 1 Model 6 WAKU Waukesha gas engine. All reshopped. Also Bessemer, Clark, Cooper compressor cylinders. Nolan Sales Corporation, 421 N. Cincinnati, Tulsa, Okla.

R L CARDWELL double drum spudder—GKU power with 93' derrick. Ready to work—bargain—will trade for casing or tubing. Call collect CE 5-1454 Oklahoma City.

VOLAND ANALYTICAL Balance, Ohaus-Howard trips and Triple Beam balances and weights. Chattilon platform scale 200 lbs. x 1 lb. Fairbanks Automatic warehouse scale 50" x 40" platform Pensky Martens Flash Point Tester. Engler viscosimeter. Misc. Chemical Laboratory utensils and equipment. Drum and barrel roller and agitator. 20,000 bbl. Fuel Oil Storage Tank 76' dia. x 25', New Western Products Co. Flame-O-Trols, Electrodes, round flame rods and alarm howler. P. O. Box A, Lyons, Ill.

7 PUMPING units—Lufkin design #B10D-20-4. Harroun & Harroun, 1910 East Pyron Road, San Antonio, Texas.

EQUIPMENT WANTED

CABLE TOOLS—Three Drum—Work to 5,000 Feet—Prefer Trailer Mounted. Box M-657, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED:

PUMPING UNITS

160,000 IPT Double reduction No. 1 Used Pumping Units needed at Gorham, Kansas. Give complete description, make and date of manufacture. Quote price present location, also price delivered. Contact H. D Lawver, Home-Stake Production Co., 2301 Philtower Bldg., Phone LU 4-5281, Tulsa, Oklahoma.

HELP WANTED

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

PLASTIC PIPE manufacturer wants young man (25-30) of proven sales ability with engineering degree. Telsco Industries, Box 18205, Dallas 18, Texas.

PROJECT ENGINEERS

NEED EXPERIENCED MECHANICAL ENGINEERS IN ANY OF THE FOLLOWING FIELDS:

MUD PUMP PARTS
VALVE DESIGN
PIPELINE COATING
PERCUSSION BITS

Location—HOUSTON, TEXAS, with established firm. Send resume to Box M-639, THE OIL AND GAS JOURNAL, Tulsa, Oklahoma

HELP WANTED

TRANSLATORS-ENGINEERS WANTED—Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian & Japanese. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N. J.

PROJECT ENGINEERS

Graduate Electrical and Civil Engineers with 5 to 8 years' experience in detail detail design of pipeline and plant facilities. Continued growth and diversification of this major company requires supervisory potential. Permanent position with excellent salary and benefits. Pleasant friendly city with good schools and housing. All qualified applicants will be considered regardless of race, color, creed or national origin. Submit resume with complete salary history to: J. Alan Hansen, Northern Natural Gas Company, P. O. Box 306, Omaha, Nebraska.

NATURAL GAS production clerk for Northern California. Duties will consist of gas chart integrator operation. Posting of data and typing. Experience on chart integrator desirable. Enclose qualifications, personal data and salary expected. Contact: Cameron Oil Company, Box 98, Meridian, California.

MECHANICAL ENGINEER

5 years experience in multi-staged high compression engines. Major chemical plant in southern location. Salary commensurate with qualifications. Age 25-35. Send resume to W. R. Hayes:

MONSANTO CHEMICAL COMPANY
Agricultural Chemicals Division
St. Louis 66, Mo.

PROCESS ENGINEERS

"Knowledge—Ability"

"Experience"

If you are a Graduate Chemical Engineer with 3 to 10 years experience in one or more of the following: Gas Plants, Gas Plant Design, Gas Treating, Sulphur Plants and General Refinery Process Design.

Furthermore, if you are interested in associating with a company that stresses diversification and you are interested in making a change to the West Coast, airmail your resume to:

Technical Personnel

PARSONS

617 West 7th St.

Los Angeles 17, Calif.

CHEMICAL ENGINEER
TECHNICAL SALES REPRESENTATIVE

Outstanding opportunity for young aggressive chemical engineer in our progressive company.

We are interested in you if you:

—Have chemical engineering degree and 2 to 10 years experience in petroleum refining.
—Prefer hard work where your efforts are rewarded.
—Like working with a minimum of supervision.
—Are willing to travel.

Send resume and photograph to:

R. J. Phillips, President, HOWE-BAKER ENGINEERS, INC.
P. O. Box 956 Tyler, Texas Phone LYric 3-6411

HELP WANTED

EXPLORATION COMPANY active in Appalachians will train young college graduate for career in oil business as landman. Send full particulars: Joe Jamar, 507 Commonwealth Bank Bldg., Butler, Pa.

WANTED: Petroleum or Mechanical Engineer for oil tool design. Experience with the operation of downhole equipment is desirable. State age, education, experience and salary expected. Box M-643, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST—Field Party Chief and Interpreter for Seismograph Contractor. Required 7 to 10 years experience with at least 5 years in West Texas and Eastern New Mexico, salary negotiable. Box M-655, The Oil and Gas Journal, Tulsa, Oklahoma.

SENIOR PROCESS ENGINEER

Experience required in designing all types of refinery process units. Splendid opportunity to advance with engineering and construction firm having world-wide representation. All replies held in strict confidence. Address or call collect:

Mr. Harry Litwin
LITWIN ENGINEERING CO.
204 N. Waco
Wichita, Kansas

SITUATIONS WANTED

POSITION WANTED in the gas industry. 30 years experience. All phases from well head to burner tip. Heavy experience in pipeline and compressor operations. Box M-635, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST DESIRES position with independent or individual where 10 years diverse domestic experience in exploration, exploitation and well completion is essential. Experience includes prospect generation, submittal evaluation and field supervision. Presently employed by major. For resume write Box M-651, The Oil and Gas Journal, Tulsa, Oklahoma.

PALEONTOLOGIST, 44 single, desires overseas position with oil company. 15 years experience with Tertiary and Cretaceous Foraminifera, and ammonites, in California, Colombia and Libya. Some field and wellsite work. Knows Spanish, learning Arabic. Box M-465, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 29, M.S., 4 years experience in Williston Basin. Subsurface mapping and carbonate studies. Desires position in exploration or research. Box M-636, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE ENGINEER—Age 32, family. Eight years with the same company. Experience in drilling, production, reservoir engineering, and evaluation. Looking for opportunity. Box M-633, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, BS, 5 years experience in South Louisiana. Desires position with aggressive independent company. Box M-642, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOPHYSICIST, 39, prefers overseas assignment. Most recently chief geophysicist of foreign company. Resume on request. Box M-641, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGICAL CONSULTANT

Ten years West Texas and New Mexico, desires retainer to represent individual or group in the Permian Basin. Box M-632, The Oil and Gas Journal, Tulsa, Oklahoma.

OFFICE MANAGEMENT AND SYSTEMS

Age 35. Fourteen years major independent GAS and OIL producing company in twelve states. Main office and field experience as Sr. Acct., Asst. Purch. Agt., Dist. Office Mgr., Systems and Procedures Supervisor in main office last 5 years. Available Jan., 62 because of merger. Resume on request.
Box M-650, The Oil and Gas Journal
Tulsa, Oklahoma

SITUATIONS WANTED

LIVE WIRE service company engineer—sales/operations experience logging, perforating, fishing, all wireline services—off shore & foreign—best references—available January. Box M-658, The Oil and Gas Journal, Tulsa, Oklahoma.

SUCCESS = INTELLIGENCE + EXPERIENCE
As a subsurface gologist with a sound judgement I can save and make you a lot of money. 20 years geological experience in major and small companies in VENEZUELA, Colombia, Bolivia, USA and Europe. Diversifield background as a subsurface geologist, field geologist, micropaleontologist, well site and consultant. Ph. D. Age 51, married, 1 baby. Excellent health. I speak and write fluently English, French, Spanish, high German and Swiss German. Character: Tough, hard worker, conscientious, accurate, loyal, I like responsibility. Presently consulting. Available immediately.
Box M-660, The Oil and Gas Journal
Tulsa, Oklahoma

LEASE AND DRILLING BLOCKS

DO YOU HAVE A LEASE TO SELL? For as little as $5 per week you can tell your proposition to over 45,000 oil men through the Journal's classified advertising pages You'll be surprised how many are interested

OIL INDUSTRY Mailing List Co., Tuloma Bldg., Tulsa, Oklahoma offers: 100 land department managers $5.00. 100 Chief Geologists $5.00. Both lists $9.00 cash. (many other oil lists).

WYOMING. SUBLETTE County 800 acres, T 29 N, R 105 W 6th P. M. all of Sec. 11, SW¼ Sec. 13. Wyoming Natrona County 1280 acres T 33 N. R 88 W. 6th P. M.—Sec. 22, E½, Sec. 23 SW¼, NE¼, Sec. 24 W½, Sec. 28 E½. 320 acres—T.26 N. Range 117 W. Sec. 12 S½. Lincoln County, Wyoming. Box M-659, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW MEXICO, Valencia Co., 640 acres, T.6N—R2W, Sec. 22 Wyoming, Lincoln Co., 654 acres, T. 22N.—R. 116 W.—Lots in both Sec. 16 and Sec. 17. Arizona, Apache Co., 640 acres, 1 10N.—R. 28 E. Sec. 36. Box M-610, The Oil and Gas Journal, Tulsa, Oklahoma.

LOCATED IN WESTERN Kentucky Mississippi Embayment. Test extremely interesting geologically. Possibilities of gas near trunk line. Hole in vicinity of Knox in proven high. Requires further development. Large acreage. Invite correspondence with reliable persons for immediate action. Write T. J. Wilson, R F D 1, Bardwell, Kentucky.

O & G LEASE for Sale 133⅓ Acres E. Esparsa Survey, Hopkins County, Texas. L. M. Bussey, Box 305, Lebanon, Tennessee.

WANTED: Large sized blocks of acreage, on trend, next to Oil or Gas Fields, in all active Texas counties, especially Val Verde County, from $30 to $100 per acre. Prompt attention given to all offers. Box M-653, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION WANTED

ST. LOUIS GROUP with substantial production interested in purchasing primary and secondary oil reserves in Illinois, Indiana, Kentucky or West Virginia. Can handle properties of any size. All replies confidential and all material forwarded will be returned. Box M-654, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

DO YOU WANT an oil income? Do you have $500.00 to help drill a well? If so I have the lease to drill. For Particulars write: Suite 416 Professional Bldg. Independence, Kansas.

WILL PAY CASH FOR MANUFACTURING OR INDUSTRIAL PLANTS, CONSTRUCTION OR TRUCKING COMPANIES WITH ASSETS $250,000.00 OR LARGER. PRINCIPALS NOT AGENTS. WRITE BOX 8257, DALLAS, TEXAS.

BUSINESS OPPORTUNITIES

DRILLING SHALLOW well immediately offsetting new producer just completed. ⅛ working interest in this new hole for $500.00. MURCO, Box 59, Cherryvale, Kansas.

CHEAP DRILLING deal: Wanted partners to participate in one or more wells in 25 well program in Devonian—Silurian Trend in Kentucky. These trends produced 100 million bbls. Wells planned average less than 300 ft. using cheap air rotary, savings will be passed on to participants. Request details Box M-656, The Oil and Gas Journal, Tulsa, Oklahoma.

YOU CAN BUY or sell your good U. S., Canadian, or Foreign Primary Oil or Gas producing Properties, thru my excellent world wide contacts. All inquiries will be given prompt attention. Box M-652, The Oil and Gas Journal, Tulsa, Oklahoma.

CALIFORNIA Oil and Gas drilling blocks, mergers and acquisitions, joint ventures. buyers and sellers of oil and gas properties, contract land work, appraisals and geological evaluations. George Malekos, Registered and Bonded, P. O. Box 722, San Francisco. Calif.

BUSINESS SERVICE

DELAWARE CORPORATION formed and serviced American Guaranty Trust Company. P. O. Box 467, Wilmington, Delaware

For your oil and gas services in the Appalachian Area
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PETROLEUM REAL ESTATE
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LANDOWNER: We offer YOU a Free Listing Service on Oil-Gas Leases and Royalty in Texas and Louisiana.

OIL INDUSTRY: We will mail YOU a Free Bulletin of the Lease Listings upon request.

Inquiries invited, and for further information write to:

BRYAN BECK
395 Tenth at Broadway Beaumont, Texas

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Division of Field Services, Washington 25, D. C. Notice is hereby given that the Government's undivided one-half mineral interest in an area of 81.19 Acres (gross), or 40.595 Acres (net), within the known geologic structure of Roxie Field, Mississippi, will be offered for oil and gas leasing in one parcel through sealed bids to the qualified bidder of the highest cash amount per net acre, at 1:00 p.m., E.S.T., December 20, 1961, when bids will be opened. Full details of the lease offering and how and where to submit bids may be obtained from the Manager, Land Office, Division of Field Services, Bureau of Land Management, Washington 25, D. C. H. K. Scholl, Manager.

LEGAL

U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Division of Field Services, Washington 25, D. C. Notice is hereby given that two parcels of land containing a total of 119.09 acres, Parcel 1 within the undefined known geologic structure of Pine Island field and Parcel 2 within the undefined known geologic structure of Monroe Gas field, Louisiana, will be offered for oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre, at 1:00 p.m., E.S.T., December 27, 1961, when bids will be opened. Full details of the lease offering and how and where to submit bids may be obtained from the Manager, Land Office, Division of Field Services, Bureau of Land Management, Washington 25, D. C. H. K. Scholl, Manager.

BUSINESS SERVICE

McWILLIAMS & LACY
Petroleum Consultants
SPECIALIZING IN—Management and operation of Properties. Evaluation of Properties and Drilling Prospects. Consultation on Operations. Economic Planning. Representation on Unitization Projects.
211 Beck Building, Shreveport, Louisiana
423-2725

LEGAL

SALE OF OIL AND GAS mining leases, allotted Indian lands, Department of The Interior, Bureau of Indian Affairs, Fort Peck Indian Agency, Poplar, Montana. Sealed bids will be received until 9:00 A.M., Mountain Standard Time, December 14, 1961, and opened at that time at the Fort Peck Indian Agency, Poplar, Montana, for the leasing of 8 tracts of individually owned trust or restricted Indian lands, comprising 1,439.52 acres located in Roosevelt and Sheridan Counties, Montana, for oil and gas mining purposes. Details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the Superintendent, Fort Peck Indian Agency, Poplar, Montana, or telephone Poplar, 768-3441.

LEGAL

THE FOLLOWING announcement is made by virtue of the powers vested in the Ministry of Finance by Order No. 1 of 1943, as amended. 1. The areas situated within the boundaries of District 1 and District 2 as described below are declared as "open" for the submission of proposals for the award of petroleum concessions therein for a period of three (3) months from Dec. 5th, 1961 ("zero date"). 2. (a) Boundaries of District 1: Commencing at the intersection of latitude 16° North and longitude 41° 20′ East; thence South along longitude 41° 20′ East in a straight line to the intersection of latitude 14° 45′ North and longitude 41° 20′ East; thence West along latitude 14° 45′ North to the intersection of latitude 14° 45′ North and longitude 40° East; thence in a North-Westerly direction in a straight line to the intersection of latitude 15° 35′ North and longitude 39° 15′ East; thence in a North-North-Westerly Direction to the intersection of latitude 16° North and longitude 39° 05′ East; thence East along latitude 16° North to the point of origin, the area enclosed in said boundaries being approximately 27,500 square kilometers in area. (b) Boundaries of District 2: Commencing at the intersection of latitude 18° 10′ North and longitude 38° 45′ East; thence in a South-South-Easterly direction to the intersection of latitude 17° 12′ North and longitude 39° 14′ East; thence East along latitude 17° 12′ North to the intersection of latitude 17° 12′ North and longitude 39° 41′ East; thence South-East in a straight line to the intersection of latitude 16° North and longitude 41° 21′ East; thence West along latitude 16° North to the intersection of latitude 16° North and longitude 39° 05′ East; Thence North-North Westerly in a straight line to the intersection of latitude 17° 30′ North and longitude 38° 40′ East; Thence North-North-Westerly in a straight line to the border between the Empire of Ethiopia and Republic of Sudan; thence along said border to the coast of the Red Sea; thence in a North-Easterly direction in a straight line to the point of origin, the area enclosed in said boundaries being approximately 27,000 square kilometers in area. 3. Any company ("applicant company") desiring to submit a proposal or proposals looking to the award of a concession covering either or both of the Districts described above shall notify the Ministry of Mines in writing. Upon said notification, and against payment of U. S. $1,000 for each District with respect to which requested, the applicant company shall be furnished with all documents required to permit the preparation of a proposal including a form of Contract of Concession, and instructions relating to the procedure to be followed in submitting proposals, and other documents. In addition, information as to exploration activities already carried on within each such District shall be made available to the applicant company. 4. Prior to ("zero date plus three months") proposals may be filed by the applicant company in accordance with the prescribed procedure. All proposals filed before (above date) shall be deemed to be filed simultaneously but shall not, however, create or vest any right in the applicant company, the Imperial Ethiopian Government reserving full right to reject any and all proposals received without cause. 5. All proposals shall be opened in public on ("zero date plus three months and one day"). Address: Ministry of Mines, P. O. Box 486. Addis Ababa, Ethiopia. Ministry of Mines, Imperial Ethiopian Government.

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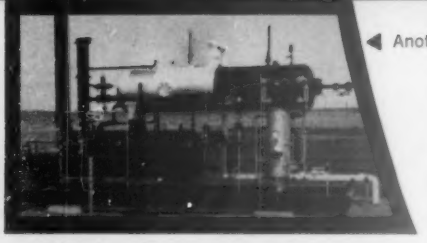

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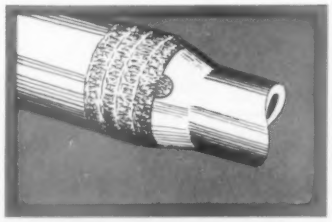

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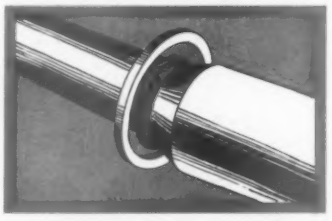

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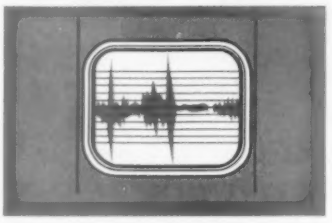

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